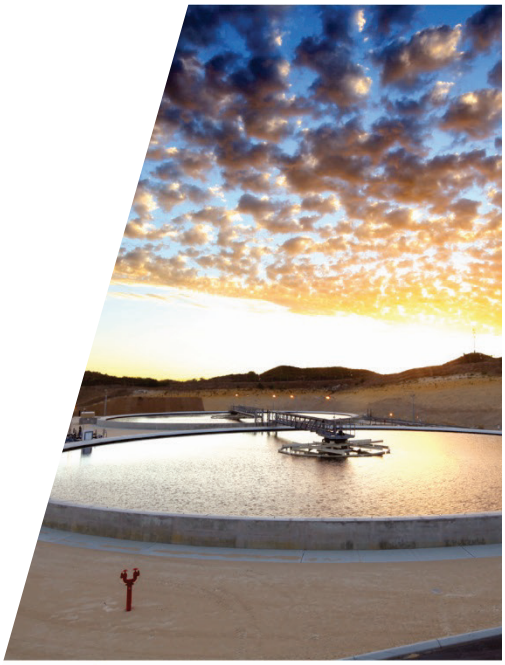

Inlet Monitoring Plan

Durez Inlet Remediation Project
North Tonawanda, New York
NYSDEC Site No. 932018
Revision of October 1995 Inlet Monitoring Plan by Rust Environment & Infrastructure (RUST)

Glenn Springs Holdings, Inc.

GHD | 2055 Niagara Falls Boulevard Niagara Falls New York 14304 USA | 007405 | Report No 54 | March 29 2019 Revision No. 1-April 5 2019

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1. Introduction

This Inlet Monitoring Plan addresses the operation, maintenance, and monitoring requirements for Occidental Chemical Corporation's (OCC's) Durez Inlet Remediation Project Site (Inlet or Site) located on the private property of East Pier Marina, 560 River Road, North Tonawanda, New York. These requirements include the dense non-aqueous phase liquid (DNAPL) extraction program, the groundwater monitoring program, post-remediation Site inspections, and periodic reporting. The Inlet Monitoring Plan is consistent with Section 11.0 of the August 1993 Approved Inlet Remedial Plan (AIRP), except for modifications to monitoring requirements made through reporting year 2018 based on over 25 years of data collected for the Site. These modifications have been approved by the New York State Department of Environmental Conservation (NYSDEC) and have been documented in the annual Periodic Review Reports (PRRs) generated for the Site. The AIRP is Appendix A of the Third Stipulation and Partial Consent Judgment (Third PCJ) filed with the United States District Court Western District of New York on October 22, 1993.

Five DNAPL extraction wells (EW-1 through EW-5, Figure 1) were installed in the North Lobe area of the Site during the Inlet Remediation Project. Extraction well construction diagrams are provided in Appendix A. These extraction wells were pumped during remedial activities and successfully removed 850 gallons of free or mobile DNAPL from the alluvium layer underlying the Site. Details of the extraction program were provided in the Inlet DNAPL Extraction Well Program Report, provided as Appendix D of the Inlet Final Engineering Report (Rust, 1995) as well as the Program Bimonthly Status Reports issued throughout the Site remedial program.

After completion of the cutoff wall, seven groundwater monitoring wells were installed to monitor North Lobe post-remediation groundwater flow directions, gradients, and quality (MW-15I, MW-16I, MW-17I, MW-18I, MW-19I, MW-20I, and MW-21S, Figure 1). Monitoring well construction logs are provided in Appendix A. Six wells were screened in the lower alluvium at its interface with the underlying confining clay layer and are designated as intermediate (I) wells. One shallow (S) well, screened at the interface between the alluvium and overlying fill layer, was installed to evaluate the relationship between the water table and the top of the cutoff wall. Based on concerns raised in 2001 that the hydraulic monitoring data in MW-20I may not be representative of the alluvium in which the well is screened, in April 2001, monitoring well MW-22I was installed in close proximity to MW-20I, with similar installation details and also screened in the lower alluvium. MW-22I has been included in the routine monitoring program for the Site since its installation. Details of cutoff wall installation and monitoring well installation and development are provided in the Inlet Final Report (Rust, 1995) and in the Sixth Year Annual Report ("Groundwater Monitoring Program, Sixth Year, Fourth Quarter Operation, Report #24 - February 2001 to April 2001, Sixth Year Annual Report").

Effective July 1, 1998, Site responsibilities were assigned by OCC to Glenn Springs Holdings, Inc. (GSH), an affiliate of OCC. Pursuant to Section 11.0 of the AIRP, GSH has been conducting the post-remediation monitoring program at the Site since that time.

1.1 In Situ Chemical Oxidation

In 1999, the NYSDEC expressed concern regarding the persistent presence of the Targeted Site Compounds (TSCs) in groundwater samples collected from monitoring well MW-20I and requested

that a work plan be prepared to investigate the source of contaminants found in MW-20I and the potential for discharge to the Little Niagara River. In response to the NYSDEC's request, GSH, on behalf of OCC, prepared the requested work plan and subsequently conducted in situ chemical oxidation (ISCO) treatment of the groundwater impacts in the vicinity of MW-20I using potassium permanganate between April 2000 and March 2001.

Detailed reports of the in situ treatment and associated monitoring have been submitted previously in the following documents:

- "MW-20I In Situ Treatment Report," November 2000
- Letter from G. Luxbacher (GSH) to J. Hyden (NYSDEC) dated March 20, 2001
- "Groundwater Monitoring Program, Sixth Year, Fourth Quarter Operation, Report #24 - February 2001 to April 2001, Sixth Year, Annual Report" (Sixth Year Annual Report)
- "Groundwater Monitoring Program, Seventh Year, First Quarter Operation, Report #25 - May 2001 to July 2001 (Report #25)

As a result of persistent detections of TSCs in MW-20I and MW-22I, NYSDEC requested GSH to develop a work plan to address the continuing detections. In response, GSH prepared a work plan and subsequently conducted ISCO by injecting activated sodium persulfate into the ground during three separate injection events from April 2011 to April 2012. A summary of the injection program is presented in "In Situ Chemical Oxidation Report MW-20I and MW-22I - Durez Inlet Remediation Program" (CRA, August 2013). The ISCO program was successful in lowering concentrations of chlorobenzene, 1,4-dichlorobenzene, and 1,3-dichlorobenzene from historical averages and trends.

2. DNAPL/Groundwater Monitoring Program

DNAPL and groundwater monitoring will continue to be performed to verify the effectiveness of the remedy in the North Lobe; e.g., extraction of free or mobile DNAPL and isolation of the residuals. Specific objectives of the DNAPL/groundwater monitoring program for the North Lobe will be as follows:

- To identify and remove, as necessary, DNAPL in the extraction well sumps
- To characterize groundwater flow directions and gradients in the vicinity of the North Lobe cutoff wall
- To identify and document long-term changes in groundwater quality in the cutoff wall area
- To inspect groundwater samples collected from the lower alluvium monitoring wells for the presence of free DNAPL

The monitoring will consist of measuring DNAPL, river stage, and groundwater levels; collecting groundwater samples to visually inspect for DNAPL and conduct chemical analysis for Site-specific chemicals as listed in the "first" Durez "Stipulation and Partial Consent Judgment Attachment B-1 - Protocols for Sampling and Analysis of groundwater" (Appendix B); and reporting the findings. DNAPL measurements, groundwater level measurements, and groundwater sampling

will be performed semiannually in October and April, at the beginning and the end of the DNAPL removal period (see below). The monitoring frequency is summarized in Table 1.

DNAPL level monitoring will determine the extent to which DNAPL has migrated into the extraction well sumps. In accordance with Section 2.1 of this Plan, DNAPL will be removed if DNAPL levels reach the top of the sump. Since the North Lobe is located at an active, privately owned marina, DNAPL removal will be coordinated with off-season activities and performed during the 6-month period between October 15 and April 15 ("DNAPL removal period") to minimize the potential for interference with the marina business.

DNAPL levels, groundwater levels, groundwater quality monitoring, and visual inspections of the Site will be used to evaluate the long-term integrity of the cutoff wall. If any observations lead to suspicion that the integrity of the cutoff wall may have been compromised, the NYSDEC will be notified immediately and the possible need for use of additional monitoring techniques on the cutoff wall will be evaluated. The results of the evaluation will be included in the next semiannual monitoring report.

2.1 DNAPL Monitoring and Removal

Specific procedures for DNAPL monitoring and criteria and procedures for DNAPL removal and disposal are described in the following sections.

2.1.1 DNAPL Level Monitoring and Removal Criteria

DNAPL levels will be measured in extraction wells with an interface probe and recorded on a form similar to the Water Elevation/DNAPL Elevation form provided in Appendix C. DNAPL elevations will be compared to the elevations of both the top of the extraction well sump and till and summarized on a form similar to the Water/DNAPL Measurements form in Appendix C. Table 2 summarizes extraction well sump depths and elevations.

Since the top of the sump is approximately 1 foot below the top of the till, DNAPL levels at or below the top of the sump would be indicative of an inward gradient toward the extraction well. Under these circumstances, any DNAPL present would move into the stainless steel well sump. If the DNAPL rises above the top of an extraction well sump, DNAPL will be removed from the sump. This removal would take place between October 15 and April 15 to minimize interference with summertime marina activities. If the DNAPL elevation is below the top of an extraction well sump, no further action is required other than routine monitoring.

If, during the boating season, DNAPL levels rise above the top of till, the local geologic conditions, including the trough-like clay confining layer, combined with the remedial structures at the Site, including the cutoff wall, would contain the DNAPL until the next off-season DNAPL removal period. If there is reason to believe, due to observations made during any Site visit or resulting from data evaluation, that the pumping frequency should be modified, such changes will be proposed to NYSDEC in the next semiannual monitoring report.

2.1.2 DNAPL Removal Procedures

Because the DNAPL extraction wells are located in a marina parking lot, extra caution will be used to prevent a spill during DNAPL removal and handling. Absorbent towels and a shovel will be

immediately available should a spill occur which requires cleanup. Materials used for spill prevention, containment, cleanup and/or personal protection; i.e., personal protective equipment (PPE), will be placed in a properly labeled drum at the Durez North Tonawanda site upon completion of DNAPL removal.

DNAPL will be removed from the extraction well sump utilizing dedicated flexible tubing with a check valve system. Removal will be conducted in such a manner as to minimize the volume of water removed. DNAPL will be pumped directly from the extraction well into a carboy, and then transported with a manifest to a properly labeled drum at the Durez North Tonawanda site. Pumping will continue until water is observed in the discharge tubing. The DNAPL level will then be measured in the well to confirm removal of the DNAPL from the sump. The volume of DNAPL recovered and fluid level measurements will be recorded.

2.1.3 Transport of DNAPL for Temporary Storage

All DNAPL and associated materials generated during DNAPL removal will be transported to the Durez North Tonawanda site for storage until off-site disposal is arranged. Containers will not be left unattended at the Inlet area.

Pursuant to the Third PCJ, Section 27(d) State Transportation and Generator fees shall not be applicable. All DNAPL generated at the Inlet will be transported and shipped in accordance with applicable regulations using a standard EPA Hazardous Waste Manifest and Generator EPA Identification Number of NYD986885440. Applicable hazardous waste codes include U019 (benzene), U037 (chlorobenzene), U070 (1,2-dichlorobenzene), U071 (1,3-dichlorobenzene), and U072 (1,4-dichlorobenzene).

2.2 Groundwater Monitoring

Specific procedures for groundwater monitoring are described in the following sections.

2.2.1 Groundwater Flow Direction and Gradients

Groundwater flow directions and gradients will be identified by measuring water levels in the eight existing monitoring wells and at the river staff gauge as shown on Figure 1 and according to the frequency indicated in Table 1. Well construction details are provided for reference in Table 3 and are also included in Appendix A. The water levels will be measured with an interface probe used for DNAPL level measurement or water level probe and recorded on the Water Elevation/DNAPL Elevation form shown in Appendix C. Total well depths will also be measured. The water levels from the intermediate wells will be tabulated, plotted and contoured, and evaluated. Water levels from the shallow well will be compared with the top of the sheet pile wall elevation to evaluate overflow. The contour map from each semiannual monitoring event and evaluation results will be provided in each semiannual groundwater monitoring report and annually in the PRR as long as monitoring of the Site is required.

2.2.2 Groundwater Quality

Long-term changes in groundwater quality will be documented by collecting and analyzing groundwater samples collected from five intermediate monitoring wells: one located upgradient of

the cutoff wall (MW-16I) and four located downgradient of the cutoff wall (MW-18I, MW-19I, MW-20I, and MW-22I). These wells are identified on Figure 1. The sampling frequency is presented in Table 1. The samples will be analyzed for the following Inlet Site-specific compounds:

- Benzene
- Toluene
- Chlorobenzene
- 1,2-Dichlorobenzene
- 1,4-Dichlorobenzene
- 1,2,3-Trichlorobenzene
- 1,2,4-Trichlorobenzene

Well purging and sample collection data will be recorded on forms similar to the Groundwater Field Sample/Purge Record form in Appendix C. Volumetric purging will be used. Temperature, specific conductivity, turbidity, and pH of the samples will be measured in the field and maintained in the sampling logs for the Site. At least three well volumes will be removed from each well prior to sampling. Sampling will not occur until the field parameters listed above have stabilized, or until ten well volumes have been removed. Stabilization for specific conductivity and temperature is achieved when these measurements are within a range of ±10 percent of the average for the last three readings. Stabilization for pH is achieved when the pH measurement is within a range of ±0.1 pH unit of the average for the last three readings. Ideally, groundwater turbidity values should be less than 5 nephelometric turbidity units (NTUs).

Sampling and analytical protocols and detection limits are set forth in the original PCJ Appendix B-1, a copy of which is included herein as Appendix B. The required detection limits have not changed. Some sampling and analytical protocols described in the original PCJ Appendix B-1 have been updated since publication of this document. Current sampling and analytical protocols accepted in the remediation industry are used in the monitoring of the Site. These current protocols serve to improve the quality of the data collected. Select GSH field protocols are included as Appendix D.

Note that Appendix B, the original PCJ Appendix B-1, includes an analytical protocol for total phenols and total organic carbon content. Analyses for these parameters will not be performed on the samples collected from the Inlet.

Groundwater samples will also be visually inspected for the presence of DNAPL. Any observations of free DNAPL or globules in water samples from wells that did not previously contain DNAPL will be reported into the State within 21 days of confirmation by GSH.

2.3 Well Inspection and Maintenance

Monitoring wells will be inspected semiannually during the semiannual Site inspections and repaired or modified as appropriate. Inspections will include observing and documenting the physical condition of the wells.

3. Other Inspections

The general condition of the remediated Inlet will be assessed by visual inspection on a semiannual basis. The frequency of this Site inspection is semiannually as approved in an email from the NYSDEC dated October 13, 2017, following review of the 2016 PRR. The NYSDEC also removed the requirement to inspect vegetation at this time. The inspection will include:

- The shoreline, river bank, and aquatic areas (for evidence of erosion)
- Any exposed portions of the Cove cap (for evidence of erosion or disturbance)
- The submerged portion of the Cove cap (for indirect evidence of disturbance; e.g., cloudy water, submerged objects, or areas of disturbance leading in or out of the Inlet)
- The North Lobe (for evidence of activity or penetrations that could compromise the effectiveness of the cutoff wall)

Results of the inspections, including a summary of recommended maintenance activities, if any, will be included in the semiannual groundwater monitoring reports. The inspection form is included in Appendix C.

4. Documentation

In addition to documentation required by the scope of work to be performed (e.g., fluid level measurements, DNAPL volumes, etc.), the following information will also be recorded, as appropriate, during implementation of Inlet Monitoring Plan Site inspections and follow-up activities:

- Date and time of arrival and departure
- Weather conditions
- Personnel performing work
- Brief description of work proposed for the day
- Location where work is performed
- Problems and corrective actions taken
- Site visitors (and their affiliations)

5. Reporting

The results of monitoring, physical inspection, and maintenance activities will be summarized in semiannual groundwater monitoring reports. Based on the results of monitoring, GSH will evaluate the need for continued monitoring and reporting and, if appropriate, may propose to the State that the monitoring or reporting frequencies be modified. The semiannual groundwater monitoring reports will summarize groundwater monitoring data, DNAPL recovery (if any), and inspection and maintenance activities, and will include an evaluation of remediation performance.

Recommendations for changes to the program, if any, will be made in the semiannual groundwater monitoring reports and/or the PRR.

An electronic copy of each semiannual groundwater monitoring report and PRR will be distributed to appropriate personnel associated with the Site. Hard copies will be distributed upon request.

6. Modification

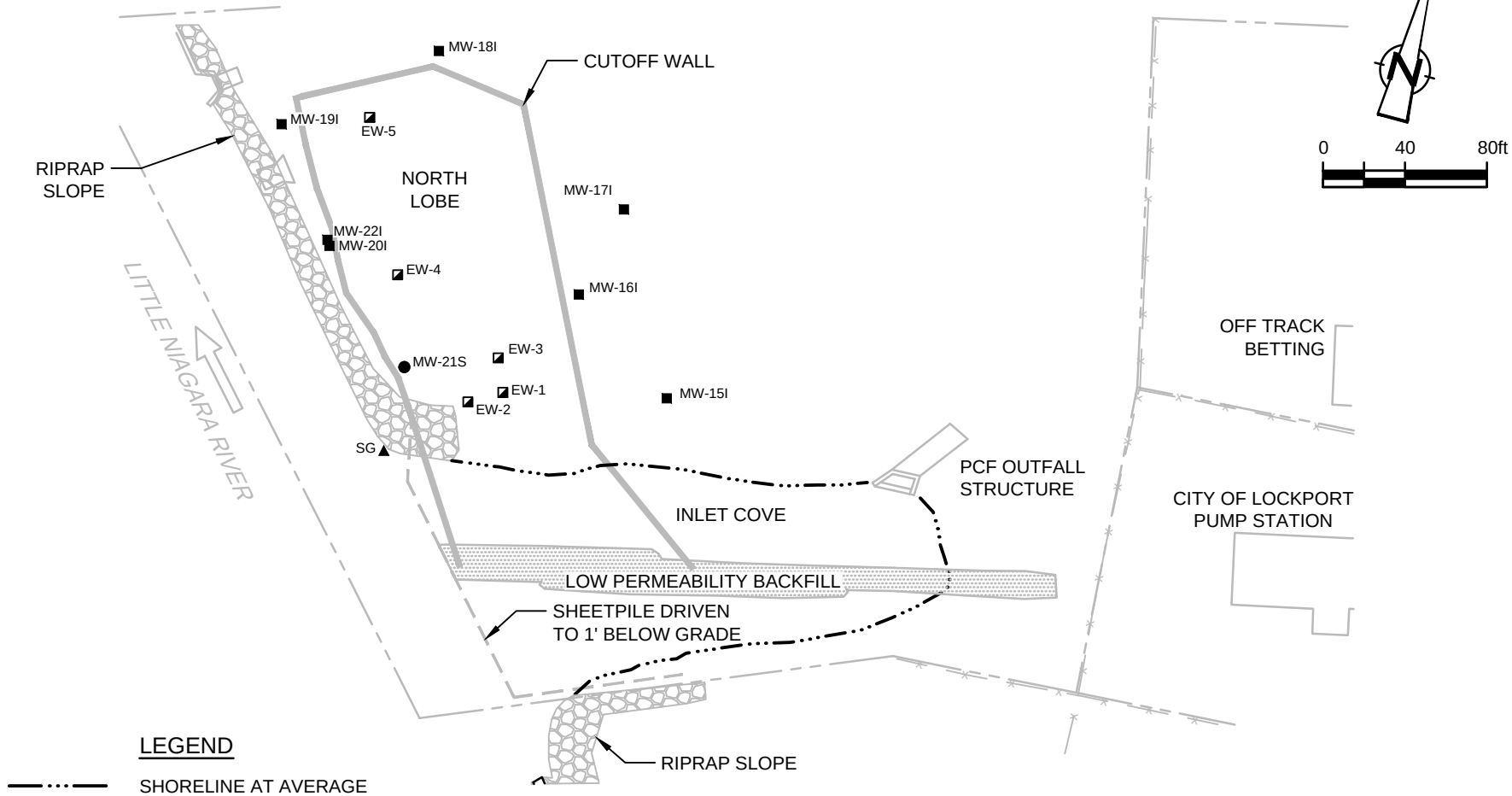
This Inlet Monitoring Plan may be modified upon the written consent of the NYSDEC.

7. Health and Safety

All activities associated with the Inlet Monitoring Plan will be conducted in accordance with the Site-specific Health and Safety Plan (HASP), which is updated as necessary.

8. Institutional Controls

Institutional controls were instituted in an easement agreement with the Property Owner to minimize the potential for damage to permanent remedial structures at the Site. These controls were addressed in the AIRP. Any violation of terms of the easement agreement by the Property Owner affecting the integrity of the institutional controls as described in the AIRP will be: a) addressed with the Property Owner by GSH both verbally and in writing, b) reported to NYSDEC for appropriate action against the Property Owner under all applicable laws and regulations, and c) reported in the next PRR.



LEGEND

- SHORELINE AT AVERAGE WATER LEVEL 565.6' AMSL
- MW-21S ● SHALLOW MONITORING WELL
- MW-15I ■ INTERMEDIATE MONITORING WELL
- EW-1 ◪ DNAPL EXTRACTION WELL
- SG ▲ STAFF GAGE

figure 1

SITE PLAN
DUREZ INLET REMEDIATION PROJECT
GLENN SPRINGS HOLDINGS, INC.
North Tonawanda, New York

GHD

P:\drawings\07000s\07405\07405-REPORT\07405-80-403(054)\07405-80-403(054)GN\07405-80-403(054)GN-WA001.DWG Plot Date: MAR 12, 2019

Table 1

Monitoring Frequency
Durez Inlet Remediation Project
North Tonawanda, New York

Activity	Frequency
DNAPL/Groundwater Monitoring Program	
1. DNAPL level measurement at five extraction wells	Semiannually, in October and April
2. Groundwater level measurement at five extraction wells and eight monitoring wells	Semiannually, in October and April
3. Extraction and monitoring well inspection	Semiannually, during sampling events
4. DNAPL removal	As necessary from October 15 to April 15 if the DNAPL level rises to the top of the extraction well sump
5. Groundwater sampling of five monitoring wells (MW-16I, MW-18I, MW-19I, MW-20I, and MW-22I), analysis for Site-specific compounds, and visual inspection for the presence of DNAPL	Semiannually, in October and April
Other Inspections	
1. Inspections of shoreline, river bank, and aquatic areas	Semiannually
2. Inspection of cove cap	Semiannually
3. Inspection of North Lobe area for evidence of activities that could impact the cutoff wall	Semiannually
Reporting	
1. Submit Groundwater Monitoring Report	Semiannually, by July 31 and January 31
2. Submit Periodic Review Report	Annually, due date determined by NYSDEC

Notes:

GSH will reevaluate the frequency and duration of monitoring activities as necessary and, if appropriate, propose an alternative schedule to the NYSDEC for approval.
DNAPL - Dense Non-aqueous Phase Liquid
NYSDEC - New York State Department of Environmental Conservation

Table 2

Extraction Well Sump Depths and Elevations
Durez Inlet Remediation Project
North Tonawanda, New York

Well Number	Elevation of Top of Pipe	Elevation of Top of Sump (ft. AMSL)	Elevation of Top of Till (ft. AMSL)	Elevation of Bottom of Sump (ft. AMSL)
EW-1	572.09	538.70	540.10	537.10
EW-2	571.89	538.52	539.40	536.92
EW-3	572.29	538.10	539.50	536.50
EW-4	572.69	538.20	539.50	536.60
EW-5	573.06	539.20	540.00	537.60

Notes:

ft. AMSL '- Feet Above Mean Sea Level

Table 3

Monitoring Well Construction Details
Durez Inlet Remediation Project
North Tonawanda, New York

Monitoring Well	Ground Elevation	Top of Riser Elevation	Bottom of Boring	Bottom of Sand Pack	Bottom of Screen	Top of Till or GLC	Top of 5-Foot Screen	Top of Sand Pack	Top of Bentonite Seal
	Elevation (feet AMSL)					Depth (feet below top of riser)			
MW-15I	570.00	569.79	23.0	22.7	22.7	21.0	17.7	16.3	13.8
MW-16I	573.50	573.31	32.5	32.5	32.5	30.7	27.5	25.9	22.5
MW-17I	574.50	574.41	28.6	28.6	28.6	26.3	23.6	21.8	18.8
MW-18I	573.70	573.51	35.0	34.9	34.9	33.5	29.9	27.0	24.0
MW-19I	572.70	572.29	35.4	35.4	35.4	33.4	30.4	27.7	23.3
MW-20I	572.60	572.35	34.5	34.5	34.5	32.5	29.5	28.0	25.8
MW-21S	572.20	572.02	10.2	10.2	10.2	See note 3	5.2	3.2	1.2
MW-22I	572.30	572.31	32.0	32.0	32.0	32.0	27.0	25.2	20.5

Notes:

AMSL - Above mean sea level
GLC - Glacio-Lacustrine Clay
MW-21S screen straddles the Fill/Upper Alluvium interface

Appendices

Appendix A
Extraction and Monitoring Well Construction Logs

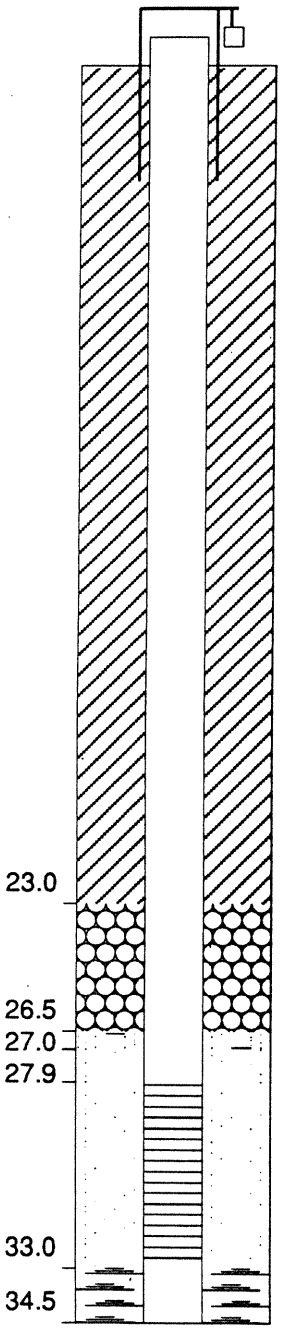
MONITORING WELL LOG

WELL NO. EW-1

DUNN ENGINEERING COMPANY
ALBANY, NY 12205
(518) 458-1313

Project: Inlet Remediation
Client: Occidental Chemical Corporation
Location: N. Tonawanda, NY
Project No.: 35630.540
Date Drilled: 12/14/93
Date Developed:

WELL CONSTRUCTION DETAIL



INSPECTION NOTES

Inspector: J. Jones
Drilling Contractor: SJB Services

Type of Well: 6" SS Extraction Well
Static Water Level Elev.: ____ Date: ____
Static Water Level Depth (from M.P.): ____
Measuring Point (M.P.): ____
Total Depth of Well: 34.5'
Total Depth of Boring: 34.5'

Drilling Method
Type: Hollow Stem Auger Diameter: 10 1/4" ID
Casing: HSA

Sampling Method
Type: SS Diameter: 2" OD
Weight: 140# Fall: 30"
Interval: 29.0-33.0

Riser Pipe Left in Place
Material: 304 Stain. Steel Diameter: 6" ID
Joint Type: Thread Length: 30'

Screen
Material: 304 Stain. Steel Diameter: 6" ID
Slot Size: 0.050" Length: 5'
Strat. Unit Screened: Till/ Alluvium

Filter Pack
Sand: X Gravel: ____ Natural: ____
Grade: Morie #3 (#0)
Amount: 460 lbs Interval: 27-33'

Seal(s)
Type: Bentonite Pellets Interval: 23-26.5'
Type: Cement/Bent. Grout Interval: 0-23'
Type: ____ Interval: ____
Type: ____ Interval: ____
Type: ____ Interval: ____

Locking Casing: Yes

Notes:

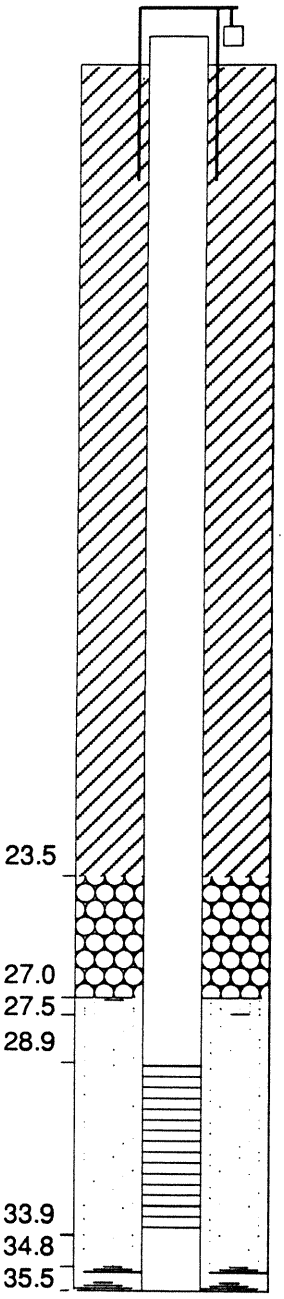
MONITORING WELL LOG

WELL NO. EW-2

DUNN ENGINEERING COMPANY
ALBANY, NY 12205
(518) 458-1313

Project: Inlet Remediation
Client: Occidental Chemical Corporation
Location: N. Tonawanda, NY
Project No.: 35630.540
Date Drilled: 12/10/93-12/13/93
Date Developed:

WELL CONSTRUCTION DETAIL



Cement/Bentonite Seal

Bentonite Seal

Sand Choke (#0 Morie)

Sand Pack (#3 Morie)

Top of Till (33')

Sump 1.6' long (surrounded by collapsed till)

INSPECTION NOTES

Inspector: J. Jones
Drilling Contractor: SJB Services

Type of Well: 6" SS Extraction Well
Static Water Level Elev.: ____ Date: ____
Static Water Level Depth (from M.P.): ____
Measuring Point (M.P.): ____
Total Depth of Well: 35.5'
Total Depth of Boring: 35.5'

Drilling Method
Type: Hollow Stem Auger Diameter: 10 1/4" ID
Casing: HSA

Sampling Method
Type: SS Diameter: 2" OD
Weight: 140# Fall: 30"
Interval: 29.5'-33.5'

Riser Pipe Left in Place
Material: 304 Stain. Steel Diameter: 6" ID
Joint Type: Thread Length: 30'

Screen
Material: 304 Stain. Steel Diameter: 6" ID
Slot Size: 0.050" Length: 5'
Strat. Unit Screened: Till/ Alluvium

Filter Pack
Sand: X Gravel: ____ Natural: ____
Grade: Morie #3 (#0)
Amount: 450 lbs Interval: 27.5-34.8'

Seal(s)
Type: Bentonite Pellets Interval: 23.5-27'
Type: Cement/Bent. Grout Interval: 0.0-23.5'
Type: ____ Interval: ____
Type: ____ Interval: ____
Type: ____ Interval: ____

Locking Casing: Yes

Notes: Total length of screen and riser 37.31'

Tracking Code: 1569A, DECWE, 05/26/94

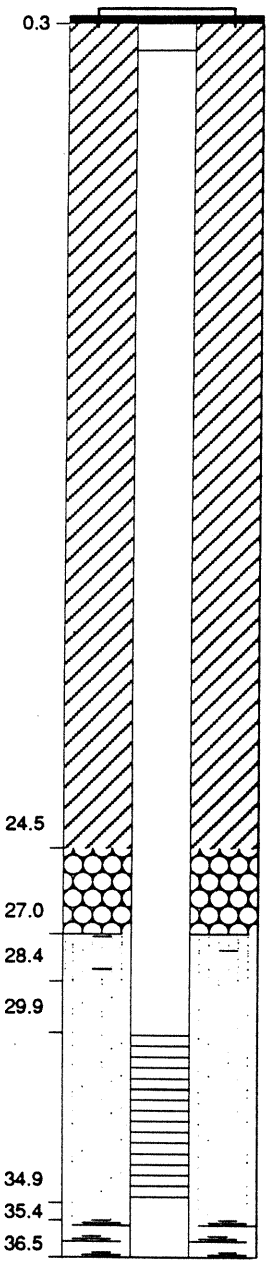
MONITORING WELL LOG

WELL NO. EW-3

DUNN ENGINEERING COMPANY
ALBANY, NY 12205
(518) 458-1313

Project: Inlet Remediation
Client: Occidental Chemical Corporation
Location: N. Tonawanda, NY
Project No.: 35630.540
Date Drilled: 12/15/93 to 12/16/93
Date Developed:

WELL CONSTRUCTION DETAIL



573.0' Ground Elev.
572.75' Measuring Point Elev.

Cement/Bentonite Seal

Bentonite Seal

Sand Choke (#0 Morie)

Sand Pack (#3 Morie)

Top of Till (33.5')

Sump 1.6' long (surrounded by collapsed till)

INSPECTION NOTES

Inspector: J. Jones
Drilling Contractor: SJB Services
Type of Well: 6" SS Extraction Well
Static Water Level Elev.: Date:
Measuring Point (M.P.):
Total Depth of Well: 36.5
Total Depth of Boring: 36.5'

Drilling Method
Type: Hollow Stem Auger Diameter: 10 1/4" ID
Casing: HSA

Sampling Method
Type: SS Diameter: 2" OD
Weight: 140# Fall: 30"
Interval: 29.5-35.5'

Riser Pipe Left in Place
Material: 304 Stain. Steel Diameter: 6" ID
Joint Type: Thread Length: 30'

Screen
Material: 304 Stain. Steel Diameter: 6" ID
Slot Size: 0.050" Length: 5'
Strat. Unit Screened: Till/ Alluvium

Filter Pack
Sand: X Gravel: Natural:
Grade: Morie #3 (#0)
Amount: 405 lbs Interval: 27.5-35.4'

Seal(s)
Type: Bentonite Pellets Interval: 24.5-27'
Type: Cement/Bent. Grout Interval: 0.0-24.5'
Type: Interval:

Locking Casing: No

Notes: Well was completed within a flush mounted road box.

Tracking Code: 1569A, DECFLUSH, 05/26/94

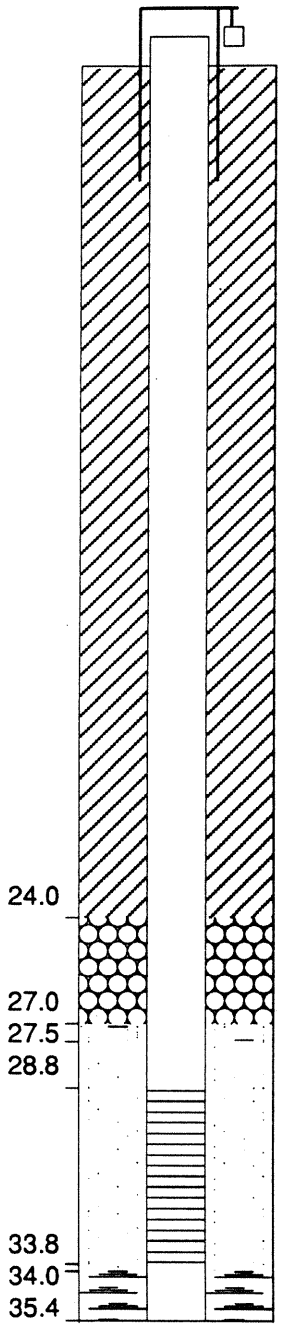
MONITORING WELL LOG

WELL NO. EW-4

DUNN ENGINEERING COMPANY
ALBANY, NY 12205
(518) 458-1313

Project: Inlet Remediation
Client: Occidental Chemical Corporation
Location: N. Tonawanda, NY
Project No.: 35630.540
Date Drilled: 12/8/93-12/9/93
Date Developed:

WELL CONSTRUCTION DETAIL



Cement/Bentonite Seal

Bentonite Seal

Sand Choke (#0 Morie)

Sand Pack (#3 Morie)

Top of Till (32.5')

Sump 1.6' long (surrounded by collapsed till)

INSPECTION NOTES

Inspector: J. Jones
Drilling Contractor: SJB Services

Type of Well: 6" SS Extraction Well
Static Water Level Elev.: Date:
Static Water Level Depth (from M.P.):
Measuring Point (M.P.):
Total Depth of Well: 35.4'
Total Depth of Boring: 36.0'

Drilling Method
Type: Hollow Stem Auger Diameter: 10 1/4" ID
Casing: HSA

Sampling Method
Type: SS Diameter: 2" OD
Weight: 140# Fall: 30"
Interval: 30.0-36.0'

Riser Pipe Left in Place
Material: 304 Stain. Steel Diameter: 6" ID
Joint Type: Thread Length: 30'

Screen
Material: 304 Stain. Steel Diameter: 6" ID
Slot Size: 0.050" Length: 5'
Strat. Unit Screened: Till/ Alluvium

Filter Pack
Sand: X Gravel: Natural:
Grade: Morie #3 (#0)
Amount: 450 lbs Interval: 27.5-34'

Seal(s)
Type: Bentonite Pellets Interval: 24-27'
Type: Cement/Bent. Grout Interval: 0.0-24'
Type: Interval:
Type: Interval:
Type: Interval:

Locking Casing: Yes

Notes:

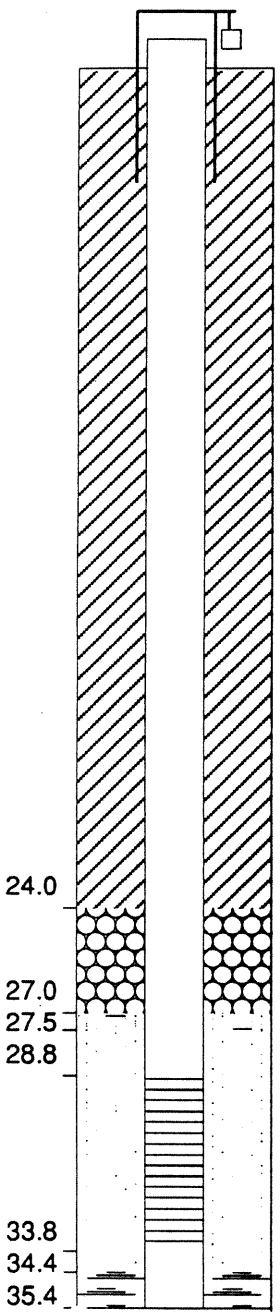
MONITORING WELL LOG

WELL NO. EW-5

DUNN ENGINEERING COMPANY
ALBANY, NY 12205
(518) 458-1313

Project: Inlet Remediation
Client: Occidental Chemical Corporation
Location: N. Tonawanda, NY
Project No.: 35630.540
Date Drilled: 12/6/93-12/8/93
Date Developed:

WELL CONSTRUCTION DETAIL



574.88' Measuring Point Elev.
573.0' Ground Elev.

Cement/Bentonite Seal

Bentonite Seal

Sand Choke (#0 Morie)

Sand Pack (#3 Morie)

Top of Till (33')

Sump 1.6' long (surrounded by collapsed till)

INSPECTION NOTES

Inspector: J. Jones
Drilling Contractor: SJB Services

Type of Well: 6" SS Extraction Well
Static Water Level Elev.: Date:
Static Water Level Depth (from M.P.):
Measuring Point (M.P.):
Total Depth of Well: 35.4'
Total Depth of Boring: 35.5'

Drilling Method
Type: Hollow Stem Auger Diameter: 10 1/4" ID
Casing: HSA

Sampling Method
Type: SS Diameter: 2" OD
Weight: 140# Fall: 30"
Interval: 29.5-33.5'

Riser Pipe Left in Place
Material: 304 Stain. Steel Diameter: 6" ID
Joint Type: Thread Length: 30'

Screen
Material: 304 Stain. Steel Diameter: 6" ID
Slot Size: 0.050" Length: 5'
Strat. Unit Screened: Till/ Alluvium

Filter Pack
Sand: X Gravel: Natural:
Grade: Morie #3 (#0)
Amount: 450 lbs Interval: 27.5-34.4'

Seal(s)
Type: Bentonite Pellets Interval: 24-27.5'
Type: Cement/Bent. Grout Interval: 0.0-24'
Type: Interval:
Type: Interval:
Type: Interval:

Locking Casing: Yes

Notes:

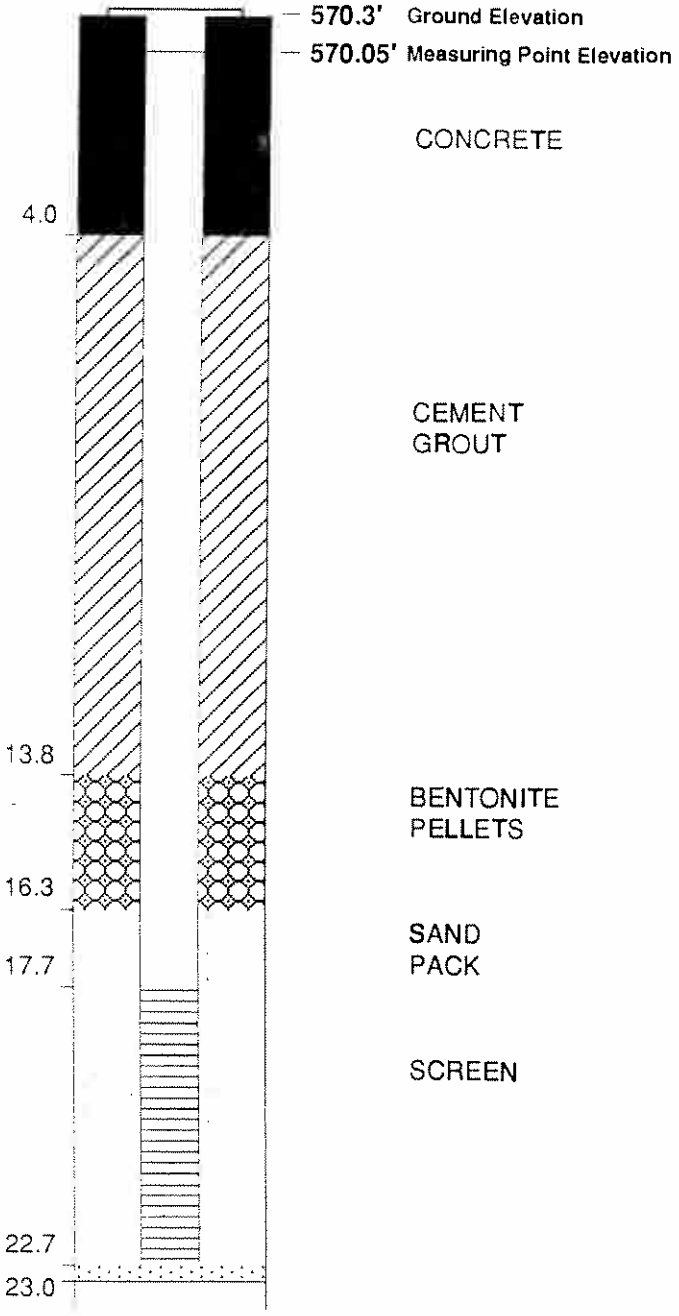
MONITORING WELL LOG

WELL NO. MW-15I

RUST ENVIRONMENT & INFRASTRUCTURE
AMHERST, NY 14228
(716) 691-3688

Project INLET REMEDIATION PROJECT
Client OCCIDENTAL CHEMICAL CORPORATION
Location North Tonawanda, NY
Project No. 35630.602
Date Drilled 02/23/95 to
Date Developed 4/21/95

WELL CONSTRUCTION DETAIL



INSPECTION NOTES

Inspector J. JONES
Drilling Contractor SJB SERVICES

Type of Well Groundwater Monitoring
Static Water Level Elev. ____ Date ____
Measuring Point (M.P.) TOP OF PVC
Total Depth of Well 22.7'
Total Depth of Boring 23.0'

Drilling Method
Type HSA Diameter 4.25"
Casing HSA

Sampling Method
Type SS Diameter 2"
Weight 140 # Fall 30"
Interval *18.0 - 22.0 Continuous

Riser Pipe Left in Place
Material Sch. 40 PVC Diameter 2" ID
Joint Type Flush Threaded Length 17.70'

Screen
Material Sch. 40 PVC Diameter 2" ID
Slot Size 0.01" Length 5.0'
Strat. Unit Screened Lower Alluvium/TIII

Filter Pack
Sand X Gravel ____ Natural ____
Grade Morie #0
Amount 2 bags Interval 22.7-16.3'

Seal(s)
Type Bentonite Pellets Interval 16.3-13.8'
Type Cement Grout Interval 13.8-4.0'
Type 3000 psi Concrete Interval 4.0 - 0.0'
Locking Casing YES

Notes: *Ground elevation when installed = 569.0'

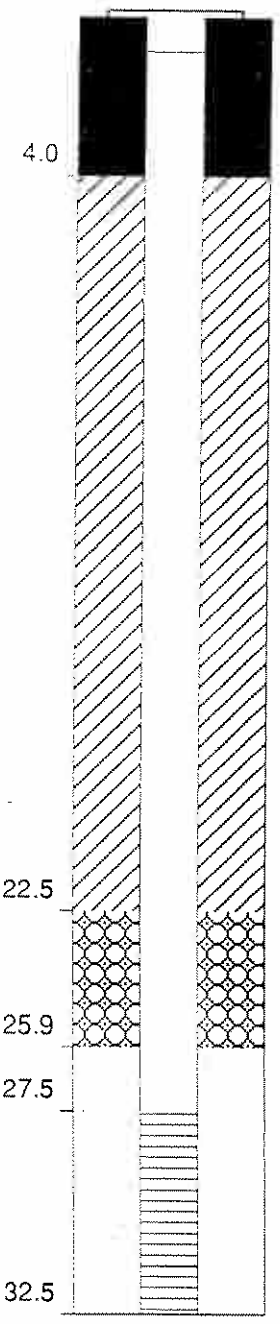
MONITORING WELL LOG

WELL NO. MW-16I

RUST ENVIRONMENT & INFRASTRUCTURE
AMHERST, NY 14228
(716) 691-3688

Project INLET REMEDIATION PROJECT
Client OCCIDENTAL CHEMICAL CORPORATION
Location North Tonawanda, NY
Project No. 35630.602
Date Drilled 02/22/95 to
Date Developed 4/21/95

WELL CONSTRUCTION DETAIL



INSPECTION NOTES

Inspector J. JONES
Drilling Contractor SJB SERVICES

Type of Well Groundwater Monitoring
Static Water Level Elev. _____ Date _____
Measuring Point (M.P.) TOP OF PVC
Total Depth of Well 32.5'
Total Depth of Boring 32.5'

Drilling Method
Type HSA Diameter 4.25"
Casing HSA

Sampling Method
Type SS Diameter 2"
Weight 140 # Fall 30"
Interval *30.0 - 32.0 Continuous

Riser Pipe Left in Place
Material Sch. 40 PVC Diameter 2" ID
Joint Type Flush Threaded Length 27.5'

Screen
Material Sch. 40 PVC Diameter 2" ID
Slot Size 0.01" Length 5.0'
Strat. Unit Screened Lower Alluvium/GLC

Filter Pack
Sand X Gravel _____ Natural _____
Grade Morie #0
Amount 2 bags Interval 32.5-25.9'

Seal(s)
Type Bentonite Pellets Interval 25.9-22.5'
Type Cement Grout Interval 22.5-4.0'
Type 3000 psi Concrete Interval 4.0 - 0.0'
Locking Casing YES

Notes: *Ground elevation when installed = 574.0'
GLC: Glacio-Lacustrine Clay

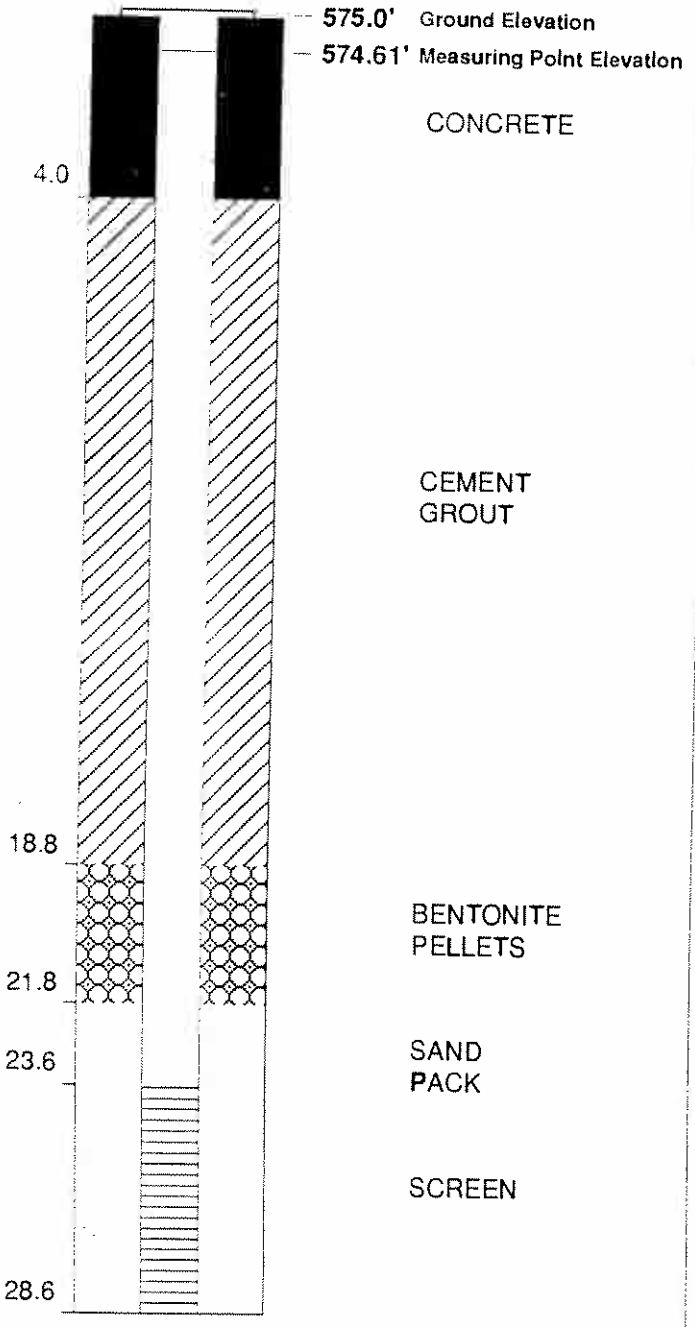
MONITORING WELL LOG

WELL NO. MW-17I

RUST ENVIRONMENT & INFRASTRUCTURE
AMHERST, NY 14228
(716) 691-3688

Project INLET REMEDIATION PROJECT
Client OCCIDENTAL CHEMICAL CORPORATION
Location North Tonawanda, NY
Project No. 35630.602
Date Drilled 02/22/95 to
Date Developed 4/21/95

WELL CONSTRUCTION DETAIL



INSPECTION NOTES

Inspector J. JONES
Drilling Contractor SJB SERVICES
Type of Well Groundwater Monitoring
Static Water Level Elev. _____ Date _____
Measuring Point (M.P.) TOP OF PVC
Total Depth of Well 28.6'
Total Depth of Boring 28.6'

Drilling Method
Type HSA Diameter 4.25"
Casing HSA

Sampling Method
Type SS Diameter 2"
Weight 140 # Fall 30"
Interval *24.0-28.0 Continuous

Riser Pipe Left in Place
Material Sch. 40 PVC Diameter 2" ID
Joint Type Flush Threaded Length 23.60'

Screen
Material Sch. 40 PVC Diameter 2" ID
Slot Size 0.01" Length 5.0'
Strat. Unit Screened Lower Alluvium/GLC

Filter Pack
Sand X Gravel _____ Natural _____
Grade Morie #0
Amount 2 bags Interval 28.6-21.8'

Seal(s)
Type Bentonite Pellets Interval 21.8-18.8'
Type Cement Grout Interval 18.8-4.0'
Type 3000 psi Concrete Interval 4.0 - 0.0'
Locking Casing YES

Notes: *Ground elevation when installed = 575.8'
GLC: Clacio-Lacustrine Clay

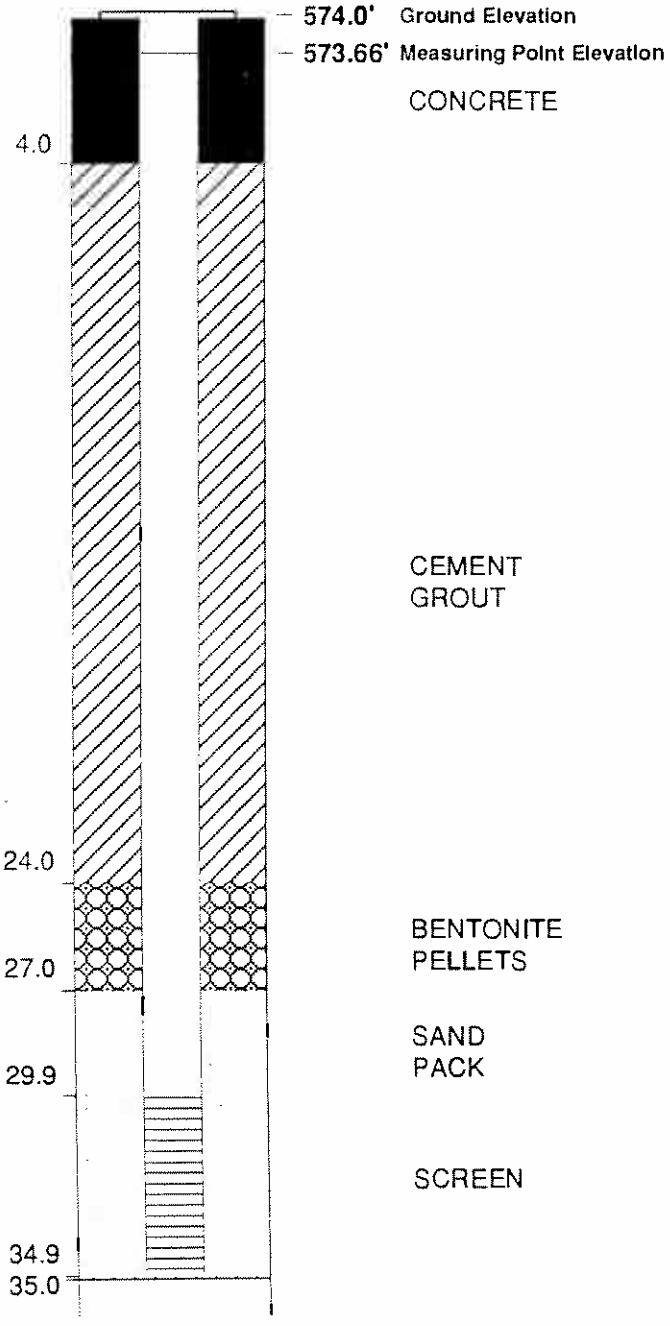
MONITORING WELL LOG

WELL NO. MW-18I

RUST ENVIRONMENT & INFRASTRUCTURE
AMHERST, NY 14228
(716) 691-3688

Project INLET REMEDIATION PROJECT
Client OCCIDENTAL CHEMICAL CORPORATION
Location North Tonawanda, NY
Project No. 35630.602
Date Drilled 02/20/95 to
Date Developed 4/21/95

WELL CONSTRUCTION DETAIL



INSPECTION NOTES

Inspector J. JONES
Drilling Contractor SJB SERVICES

Type of Well Groundwater Monitoring
Static Water Level Elev. ____ Data ____
Measuring Point (M.P.) TOP OF PVC
Total Depth of Well 34.9'
Total Depth of Boring 35.0'

Drilling Method
Type HSA Diametar 4.25"
Casing HSA

Sampling Method
Type SS Diameter 2"
Weight 140 # Fall 30""
Interval *19.5-34.0

Riser Pipe Left in Place
Material Sch. 40 PVC Diameter 2" ID
Joint Type Flush Threaded Length 17.70'

Screen
Material Sch. 40 PVC Diameter 2" ID
Slot Size 0.01" Length 5.0'
Strat. Unit Screened Lower Alluvium/Till

Filter Pack
Sand X Gravel ____ Natural ____
Grade Morie #0
Amount 2 bags Interval 34.9-27.0'

Seal(s)
Type Bentonite Pellets Interval 27.0-24.0'
Type Cement Grout Intervat 24.0-4.0'
Type 3000 psi Concrete Intervel 4.0 - 0.0'
Locking Casing YES

Notes: *Ground elevation when installed = 573.6'

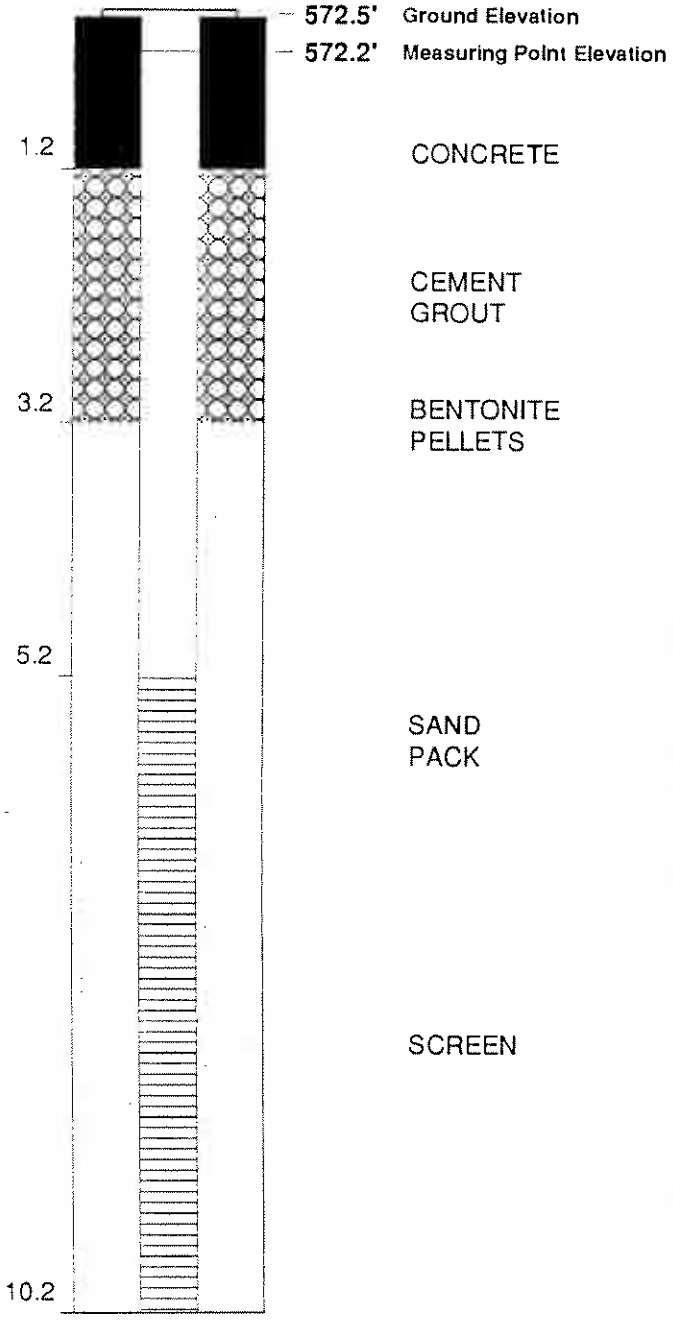
MONITORING WELL LOG

WELL NO. MW-21S

RUST ENVIRONMENT & INFRASTRUCTURE
AMHERST, NY 14228
(716) 691-3688

Project INLET REMEDIATION PROJECT
Client OCCIDENTAL CHEMICAL CORPORATION
Location North Tonawanda, NY
Project No. 35630.602
Date Drilled 02/23/95 to
Date Developed 4/27/95

WELL CONSTRUCTION DETAIL



INSPECTION NOTES

Inspector J. JONES
Drilling Contractor SJB SERVICES

Type of Well Groundwater Monitoring
Static Water Level Elev. _____ Date _____
Measuring Point (M.P.) TOP OF PVC
Total Depth of Well 10.2'
Total Depth of Boring 10.2'

Drilling Method
Type HSA Diameter 4.25"
Casing HSA

Sampling Method
Type SS Diameter 2"
Weight 140 # Fall 30"
Interval *6.0-10.0 Continuous

Riser Pipe Left in Place
Material Sch. 40 PVC Diameter 2" ID
Joint Type Flush Threaded Length 5.2'

Screen
Material Sch. 40 PVC Diameter 2" ID
Slot Size 0.01" Length 5.0'
Strat. Unit Screened Upper Alluvium/Fill

Filter Pack
Sand X Gravel _____ Natural _____
Grade Morie #0
Amount 2 bags Interval 10.2-5.2'

Seal(s)
Type Bentonite Pellets Interval 3.2-1.2'
Type _____ Interval _____
Type 3000 psi Concrete Interval 1.2 - 0.0'
Locking Casing YES

Notes: *Ground elevation when drilled = 572.0'

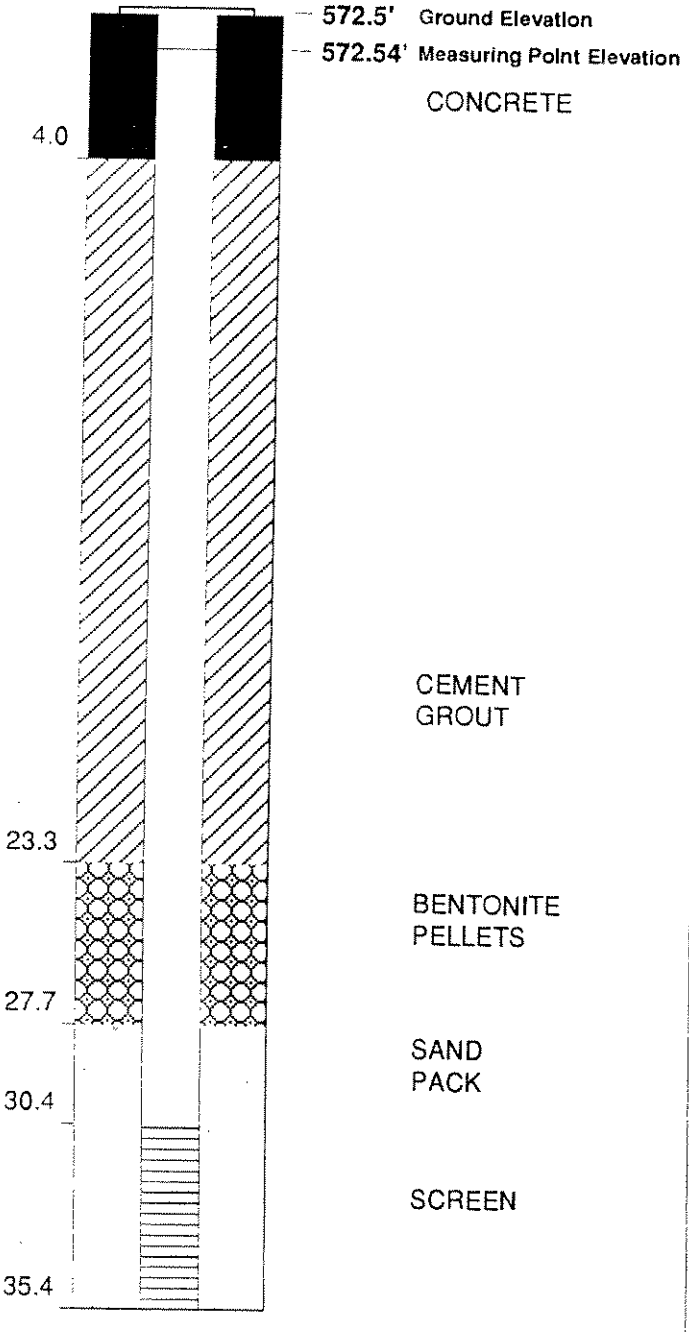
MONITORING WELL LOG

WELL NO. MW-19I

RUST ENVIRONMENT & INFRASTRUCTURE
AMHERST, NY 14228
(716) 691-3688

Project INLET REMEDIATION PROJECT
Client OCCIDENTAL CHEMICAL CORPORATION
Location North Tonawanda, NY
Project No. 35630.602
Date Drilled 02/20/95 to
Date Developed 4/21/95

WELL CONSTRUCTION DETAIL



INSPECTION NOTES

Inspector J. JONES
Drilling Contractor SJB SERVICES

Type of Well Groundwater Monitoring
Static Water Level Elev. ____ Date ____
Measuring Point (M.P.) TOP OF PVC
Total Depth of Well 35.4'
Total Depth of Boring 35.4'

Drilling Method
Type HSA Diameter 4.25"
Casing HSA

Sampling Method
Type SS Diameter 2"
Weight 140 # Fall 30"
Interval *29.5-35.5 Continuous

Riser Pipe Left in Place
Material Sch. 40 PVC Diameter 2" ID
Joint Type Flush Threaded Length 30.4'

Screen
Material Sch. 40 PVC Diameter 2" ID
Slot Size 0.01" Length 5.0'
Strat. Unit Screened Lower Alluvium/Till

Filter Pack
Sand X Gravel ____ Natural ____
Grade Morie #0
Amount 2 bags Interval 35.4-27.7'

Seal(s)
Type Bentonite Pellets Interval 27.7-23.3'
Type Cement Grout Interval 23.3-4.0'
Type 3000 psi Concrete Interval 4.0 - 0.0'
Locking Casing YES

Notes: *Ground elevation when installed = 572.6

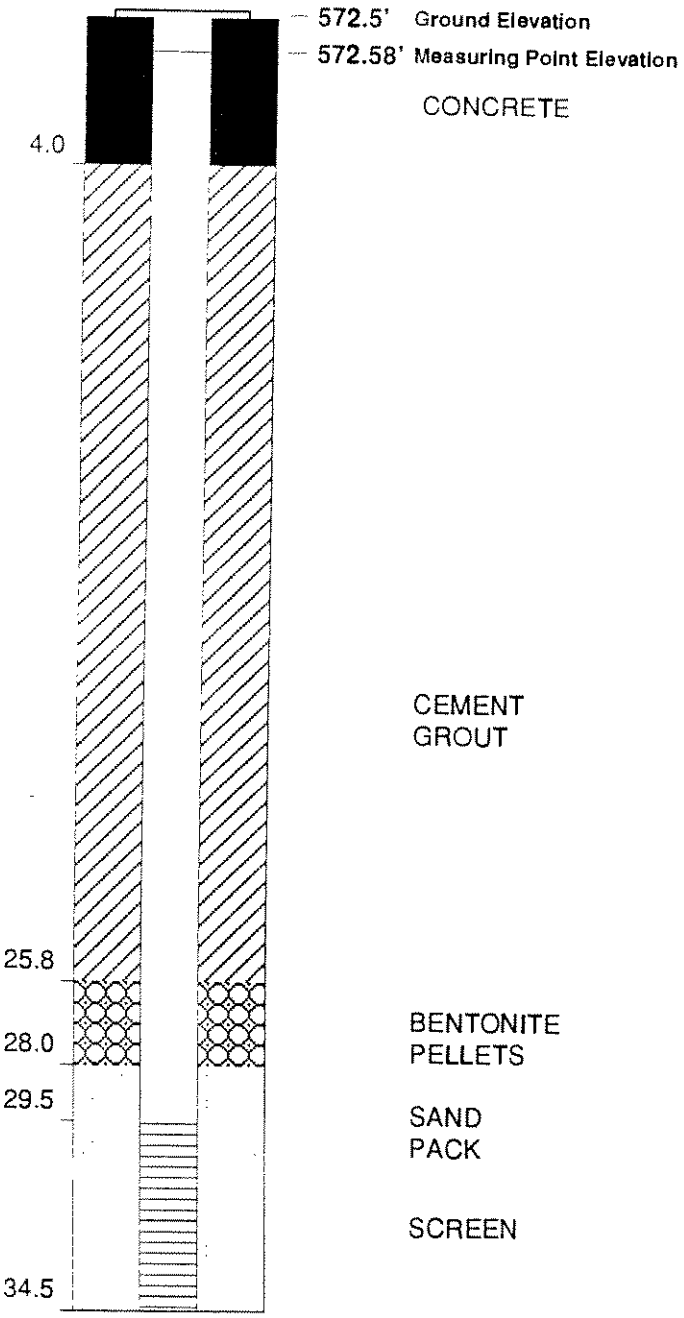
MONITORING WELL LOG

WELL NO. MW-20I

RUST ENVIRONMENT & INFRASTRUCTURE
AMHERST, NY 14228
(716) 691-3688

Project INLET REMEDIATION PROJECT
Client OCCIDENTAL CHEMICAL CORPORATION
Location North Tonawanda, NY
Project No. 35630.602
Date Drilled 02/22/95 to
Date Developed 4/21/95

WELL CONSTRUCTION DETAIL



INSPECTION NOTES

Inspector J. JONES
Drilling Contractor SJB SERVICES

Type of Well Groundwater Monitoring
Static Water Level Elev. _____ Date _____
Measuring Point (M.P.) TOP OF PVC
Total Depth of Well 34.5'
Total Depth of Boring 34.5'

Drilling Method
Type HSA Diameter 4.25"
Casing HSA

Sampling Method
Type SS Diameter 2"
Weight 140 # Fall 30"
Interval *30.0-34.0 Continuous

Riser Pipe Left in Place
Material Sch. 40 PVC Diameter 2" ID
Joint Type Flush Threaded Length 29.5'

Screen
Material Sch. 40 PVC Diameter 2" ID
Slot Size 0.01" Length 5.0'
Strat. Unit Screened Lower Alluvium/Till

Filter Pack
Sand X Gravel _____ Natural _____
Grade Morie #0
Amount 2 bags Interval 34.5-28.0'

Seal(s)
Type Bentonite Pellets Interval 28.0-25.8'
Type Cement Grout Interval 25.8-4.0'
Type 3000 psi Concrete Interval 4.0 - 0.0'
Locking Casing YES

Notes: *Ground elevation when installed = 572.1'

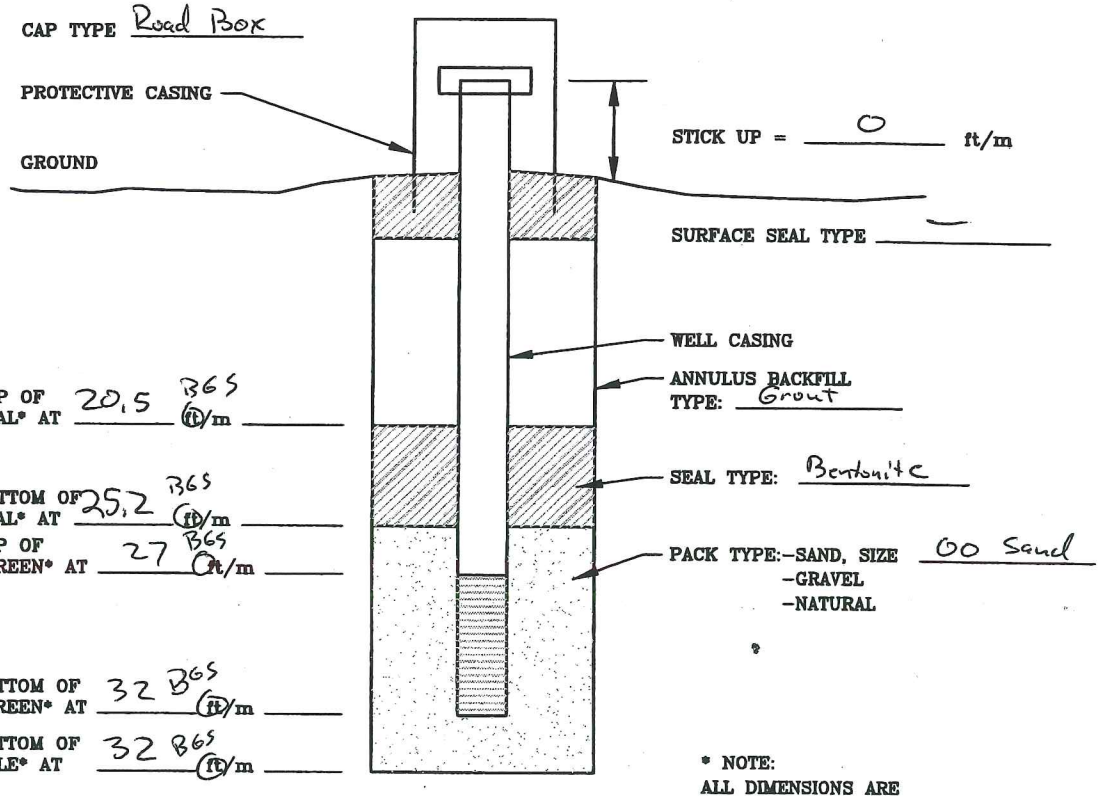
-7405

Field File

OVERBURDEN INSTRUMENTATION LOG

PROJECT NAME Dureze Inlet
PROJECT NUMBER 7405
CLIENT
LOCATION North Tonawanda NY

HOLE DESIGNATION 22I
DATE COMPLETED 4/12/01
DRILLING METHOD 4¼ HSA
CRA SUPERVISOR J. Raby



SCREEN TYPE: ☒ continuous slot ☐ perforated ☐ louvre ☐ other:

SCREEN MATERIAL: ☐ stainless steel ☒ plastic ☐ other:

SCREEN LENGTH: 5 ft/m SCREEN DIAMETER: 2" in/cm SCREEN SLOT SIZE: #10

WELL CASING MATERIAL: PVC WELL CASING DIAMETER: 2 in/cm

HOLE DIAMETER: 8½

DEVELOPMENT: METHOD: DURATION:

CRA

Appendix B
Sampling and Analytical Protocol (PCJ Appendix B-1)

UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF NEW YORK

THE STATE OF NEW YORK,

Plaintiff,

-and-

THE CITY OF NORTH TONAWANDA,

Plaintiff-Intervenor,

-against-

OCCIDENTAL PETROLEUM CORPORATION, HOOKER CHEMICAL CORPORATION, and OCCIDENTAL CHEMICAL CORPORATION,

Defendants.

Index No. 83-552-C

ATTACHMENT B—1
PROTOCOLS FOR SAMPLING
and
ANALYSIS OF GROUNDWATER

ATTACHMENT B-1
Protocols for Sampling and Analysis of Groundwater

Table of Contents

ATTACHMENT B-1
PROTOCOLS FOR SAMPLING AND ANALYSIS OF GROUNDWATER

INTRODUCTION

The following protocols describe the methodology to be employed for sampling and analysis of groundwater at the Durez plant during remediation, as described in Appendix B -- Monitoring, Operations and Maintenance Plan and Appendix C -- Cell Report.

Water samples collected from the Durez Temporary Facility (DTF), selected groundwater monitoring wells and the Cell leak detection system will be analyzed for the following parameters:

Compound	Method Detection Limit (µg/L)
Benzene	1
Toluene	1
Monochlorobenzene	1
Orthochlorotoluene	1
1,2-Dichlorobenzene	1
1,4-Dichlorobenzene	1
1,2,3-Trichlorobenzene	1
1,2,4-Trichlorobenzene	1
Total Phenols	10
TOC	1000
Other Parameters	
pH	Field measurement
temperature	Field measurement
conductivity	Field measurement

The protocols have been divided into three sections. The first section describes the methodology to be used for sampling, safety, bottle cleaning, sample preservation, storage and chain of custody. The second section describes the methodology for the parameters which will be analyzed. The

third section describes a general quality assurance plan which an environmental laboratory should strive to achieve. Specific quality assurance protocols are included with the methodology for each analysis.

PROTOCOLS FOR SAMPLING

PROTOCOLS FOR SAMPLING

I. SAMPLING

A. General

Sampling will be performed by a two-person team with experience in environmental sampling. The senior member of the team will be responsible for complete documentation of sampling which will be kept in a field notebook with bound pages, appropriately dated and signed. The sampling team will be responsible for the preservation of all samples. They also will be responsible for conducting pH, temperature and conductivity tests. The team also shall maintain chain of custody records for all samples until they are shipped to the analytical laboratory. The chain of custody form is attached.

The State will have the option to obtain splits of samples taken in connection with the program.

B. Groundwater

Wells will be sampled after purging at least four volumes of the well casing. Samples for volatiles analysis will be bailed; all other purging and sampling will be performed using a peristaltic pump and teflon sampling lines. For each site, approximately 1 liter of water will be collected for field measurements. Additionally, 2 hypovials and 2 one-liter bottles of water will be collected for laboratory analyses.

TOC and phenol samples will be preserved with sulfuric acid to a pH of <2 (Ref. 1). All caps will be "Teflon" lined. All samples will be kept at 4°C in a refrigerator or on wet ice at all times.

Conductivity, pH and temperature measurements will be made in the field.

II. SAMPLE CONTAINER PREPARATION

The waters used in bottle cleaning and as blank water for this study are defined below:

Distilled water will be tap water single distilled from a glass still. Blank water will be a distilled-low carbon-deionized water produced with a modified Millipore-Milli-Q system. Starting with single distilled tap water, the water is passed through Millipore cartridges in the sequence, carbon, Ion-X, Ion-X and Organex Q.

All bottles used in this study, except for gallon bottles used to transport blank water, will be new and will be cleaned according to the procedure given below, or equivalent:

A. Hypovials

Bottles for the volatile organic compounds will be cleaned as follows:

1. Caustic detergent wash
2. Tap water rinse
3. Distilled water rinse
4. Oven dry at 250°C for 1 hr.
5. Cap with clean septum

B. Septa for Hypovials and Teflon Cap Liners

Teflon lined silastic septa for the hypovials and Teflon film cap liners for the other bottles will be cleaned as follows:

1. Caustic detergent wash
2. Tap water rinse
3. Distilled water rinse
4. Oven dry at 110°C for 1 hr.

C. Phenols and TOC

Bottles for the water samples to be analyzed for phenols and total organic carbon will be cleaned the same as hypovials, above.

D. Blank Water Bottles

Bottles for the blank water that will be used in the field will be cleaned as follows:

1. Caustic detergent wash
2. Tap water rinse
3. Distilled water rinse
4. Acetone rinse
5. Hexane rinse
6. Acetone rinse
7. Blank water rinse
8. Oven dry at 110°C for 1 hr.

III. QUALITY ASSURANCE

The quality assurance program entitled "Environmental Laboratory, General Quality Assurance Plan", ("General QA Plan") as set forth below, will be followed for the sampling program described herein.

IV. SAMPLE CUSTODY

The chain of custody procedures will be as described in the General QA Plan, with the attached form being used for documentation.

V. PERISTALTIC PUMP OPERATION AND CLEANUP

The peristaltic pump used for obtaining liquid samples from the DTF drainage collection system, wells and the Cell leak detection system will utilize the shortest possible length of silastic (ISCO) tubing in the pumping chamber. Feed and delivery lines will be "Teflon" tubing. The silastic tubing will be precleaned in the laboratory by using it to pump one gallon of hot (60-70°C) detergent solution (2.5 oz. of "Micro" per gallon of distilled water). Peristaltic pump tubing and "Teflon" feed and delivery lines will be changed after sampling at each location, to prevent the possibility of cross contamination. If a location must be resampled, the originally used tubing at that location may be reused.

VI. FIELD SAMPLING SAFETY PROGRAM

All sampling and related field activities performed under the remedial program shall be performed in a manner that protects the safety and health of the field sampling personnel and the general public.

A. Safety Rules

All field personnel will conform to plant safety rules which are applicable to the Durez facility while on Durez property. A copy of these rules, as well as a copy of this Field Sampling Safety Program, will be provided to each OCC employee and each contractor employee who will be involved in the field activities. Employees will also be briefed on the contents of this Program.

B. OCC Project Coordinator

OCC will designate an OCC Project Coordinator to oversee the field activities and to insure that the activities are conducted in compliance with this Field Sampling Safety Program. During the conduct of field activities, the OCC Project Coordinator may revise this Field Sampling Safety Program appropriately to insure that the safety and health of the field personnel and general

public are protected. In this event, OCC will provide notification thereof in writing to the State. The OCC Project Coordinator shall have a minimum of 40 hours of health and safety training. The Project Coordinator shall also have a sound working knowledge of State and Federal occupational safety and health regulations, Durez plant safety and health procedures, and protective equipment to be used during implementation of the monitoring program.

C. Protective Clothing and Equipment

Personnel involved in the field activities, as well as all others who come into direct contact with soil or water removed during sampling, will wear hard hats, safety glasses/goggles, protective gloves, and protective boots. Approved respirators for each person will be readily available and maintained in a clean location.

If disposable clothing is used, it will be disposed of properly with other waste from the project. Nondisposable garments will be cleaned either on-site or by commercial laundry.

D. Emergency Equipment and Procedures

Appropriate emergency equipment, including, without limitation, eye-wash stations, fire extinguishers, and first aid kits will be available and near any location where field sampling activities are being conducted. In addition, a safety station will be located near the work area. Personnel trained in first aid techniques will be present on the Property whenever such field sampling activities are being conducted.

VII. DISPOSAL OF WATER

Water removed during sampling will be disposed of in compliance with applicable regulations in an environmentally responsible manner.

VIII. REFERENCES

1) 40 CFR Part 136, as revised July 1, 1987: Table II, pp 264-266.

PROTOCOLS FOR ANALYSES

PROTOCOLS FOR ANALYSES

I. INTRODUCTION:

The following methodology applies to the analysis of water for the following parameters:

Benzene
Toluene
Monochlorobenzene
Orthochlorotoluene
1,2-Dichlorobenzene
1,4-Dichlorobenzene
1,2,3-Trichlorobenzene
1,2,4-Trichlorobenzene
Total Phenols

Water samples will also be analyzed for total organic carbon (TOC) content, pH, conductivity and temperature.

Sections II A and II B describe the two alternative methods for the analysis of designated organics in water. Section II C describes the methodology for TOC analysis and Section II D describes the methodology for pH, conductivity, temperature and total phenols measurements. Section III describes the specific quality assurance program to be used.

The purge and trap method described in Section II A is presently used for Durez outfall monitoring analyses. It has been in use for over eight years and considerable quality assurance data have been developed for the method. The disadvantage of purge and trap is that each analysis takes over one hour to complete and therefore very few can be run in one day.

The microextraction method described in Section II B may be used as an alternate method. The microextraction method is a much simpler method.

II. METHODOLOGY:

A. Methodology for volatile organic compounds using a purge and trap technique

This method analyses for benzene, toluene, monochlorobenzene, orthochlorotoluene, 1,2- and 1,4-dichlorobenzene, 1,2,3- and 1,2,4-trichlorobenzene. The method detection limit is 1 µg/L.

1. Standard Preparation

Approximately 0.10 g each of benzene, toluene, monochlorobenzene, orthochlorotoluene, 1,2-dichlorobenzene, 1,2,3-trichlorobenzene, and 1,2,4-trichlorobenzene will be weighed accurately into a 10 ml volumetric bringing to volume with methylene chloride. Dilutions are made in ethanol to the levels of 1,000, 100, 10 and 1 mg/L. Appropriate aliquots are diluted in distilled Milli-Q water to provide standards in the desired concentration range for calibration.

2. Sample Preparation

The sample volume used is dependent on the levels of the components analyzed for. Low level samples have a purge volume of 15 mls and high level samples have a purge volume of 0.5mls and 4.5 mls of Milli-Q water. After a 30 minute purge, the samples are desorbed for five minutes from the tenax trap to the gas chromatograph.

Purge and Trap Parameters

Instrument	-	Tekmar Liquid Sample Concentrator Model LSC-2
Trap	-	Tenax
Purge	-	30 minutes
Flow	-	30 ml/minute
Carrier Gas	-	Nitrogen
Desorb Time	-	5 minutes
Temperature	-	200°C

Gas Chromatography Parameters

Instrument	-	Hewlett Packard Gas Chromatograph with Flame Detector
Carrier Gas	-	Helium at 15cc/minute
Make-up Gas	-	Nitrogen at 15cc/minute
Injection Port	-	200°C
Detector Temperature	-	275°C
Column	-	30ft. x 0.53mm i.d. Restex Rtx - megabore column of crossbonded Phenyl Methyl Polysiloxane
Oven	-	25°C Initial
Program	-	10°C for 6 minutes, 2.5°C/minute to 75°C, hold 5 minutes;10°C/minute to 110°C, hold 5 minutes; 20°C/minute to 240°C, hold 5 minutes

B. Methodology for analysis of water samples using microextraction procedure.

1. Introduction

The microextraction procedure described below can be used for the determination of the compounds listed in Table 1 in this section on the water samples.

Samples are extracted with pentane at a sample to solvent ratio of 100:1. The sample extracts are analyzed using gas chromtography with a flame ionization detector.

2. Apparatus

- Volumetric flasks - long neck - 100 ml
- Syringes - 10 µl
- G.C. Columns: J&W Durabond DB-1 thick film fused silica 30m x 0.321 mm id
- Alternative G.C. Column: J&W DB-5 thick film fused silica capillary column 30m x 0.321 mm id
- Gas Chromatograph with Flame Ionization Detector
- Electronic Integrator

3. Reagents

- Pentane "Distilled in Glass" quality
- Methanol "Distilled in Glass" quality
- Sodium Chloride
- Sulfuric Acid
- Prepurified Air
- Prepurified Hydrogen
- Helium-Ultra High Purity
- Nitrogen-Ultra High Purity

4. Microextraction

A 100 ml aliquot of a thoroughly mixed sample which has been collected in a 100 ml long neck volumetric flask will be acidified to pH2 with 1:1 H_2SO_4. Ten grams of Sodium Chloride are added directly to the aqueous sample. One ml of pentane will be added to the volumetric flask and the sample will be hand shaken for five minutes. The final volume of pentane will be checked and adjusted as necessary.

5. Analysis of Sample Extracts

One (1) µl of the extract will be injected into the G.C. The relationship between the found concentration values and the concentration of the aqueous sample is as follows:

$$\frac{X\ \mu g/ml \times 1\ ml\ pentane}{100\ ml} = Y$$

where X = found concentration

Y = concentration in aqueous sample (µg/ml)

Oven temperature programming and gas flows will be adjusted for optimum chromatographic performance. The following is an example of the G.C. oven program for the FI/GC sample analysis:

Oven Temperature	1	Initial Value	25°C
Oven Temperature	1	Initial Time	6 min
Oven Temperature	1	Program Rate	8°C
Oven Temperature	2	Final Value	250°C
Oven Temperature	2	Final Time	2 min

Appendix C
Forms

Date: _____

GSH
Water/DNAPL Measurements
Occidental Chemical Corporation
Durez Inlet Site, North Tonawanda, New York

Project #: _____

Well #	Time	Elevation of Top of Pipe	Depth to Water	Depth to Bottom	Depth to NAPL	*Depth below Top of Pipe- DNAPL Req'd. to be Pumped	DNAPL Removed (gallons)	Well Integrity			
								Locked	Capped	Cracked	Obstructed
MONITORING WELLS											
MW-151		569.79				NA					
MW-161		573.31				NA					
MW-171		574.41				NA					
MW-181		573.51				NA					
MW-191		572.29				NA					
MW-201		572.35				NA					
MW-21S		572.02				NA					
MW-22I		572.31				NA					
EXTRACTION WELLS											
EW-1		572.09				≤33.49					
EW-2		571.89				≤33.49					
EW-3		572.29				≤34.29					
EW-4		572.69				≤34.59					
EW-5		573.06				≤33.96					
STAFF GAUGE											
SG-1		567.66									
SG-1		567.66									

Description of Site:

Site Conditions:

Weather: Temperature:

W/L Meter - **Interface Probe -**

Notes:
- DNAPL requires pumping/removal when it reaches the top of the extraction well (EW) sumps

* - Depths listed are representative of the depth of the top of the sump from the top of the pipe

NM - Not measured

NN - No DNAPL present

NA - Not applicable

Notes:

OCCIDENTAL PETROLEUM CORPORATION
GLENN SPRINGS HOLDINGS
DUREZ INLET MONITORING

GROUNDWATER FIELD SAMPLE/PURGE RECORD

STATION # 16I

WEATHER NOTES:_____

DATE _____ WELL DEPTH: 32.5 FT. WATER DEPTH: _____ FT.

WELL VOLUME: _____ GAL. TOTAL VOLUME PURGED _____ GAL.
1.25" = 0.06 2" = 0.163
ZONE MONITORED: ___OB___ WELL DIAMETER: ___2.0___ "

SAMPLE PURGE DATA:

START _____ GAL.
TEMP. _____ DEG C.
SPCON_____ MOHS
TURBID. _____ NTU'S
pH _____
TIME _____
HR/MIN _____
TOTAL
VOL. _____ GALS.

START_____GAL.
TEMP. _____ DEG.C.
SPCON_____MOHS
TURBID._____NTU'S
pH _____
TIME_____
HR/MIN_____
TOTAL
VOL. _____GALS.

START_____GAL.
TEMP. _____DEG.C.
SPCON_____MOHS
TURBID._____NTU'S
pH_____
TIME_____
HR/MIN_____
TOTAL
VOL._____GALS.

START _____ GAL.
TEMP. _____ DEG.F.
SPCON_____ MOHS
TURBID. _____ NTU'S
pH _____
TIME _____
HR/MIN _____
PURGE
VOL. _____ GALS.

START_____GAL.
TEMP. _____ DEG.F.
SPCON_____MOHS
TURBID._____NTU'S
pH _____
TIME_____
HR/MIN_____
PURGE
VOL. _____GALS.

SAMPLING
TEMP. _____DEG.F.
SPCON_____MOHS
TURBID._____NTU'S
pH_____
TIME_____
FINAL LEVEL _____
FINAL H20 QTY _____

REMARKS/OBSERVATIONS _____
_____
_____
_____

SAMPLE NUMBER_____TIME SAMPLED:_____ DATE_____
QA/QC Y/N MS? MSD? FIELD BLANKS?_____
DEC SPLIT Y/N VOCs TOC TOTAL PHENOLICS
PURGING CREW _____
SAMPLING CREW _____

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GLENN SPRINGS HOLDINGS
DUREZ INLET MONITORING
GROUNDWATER FIELD SAMPLE/PURGE RECORD

STATION # 18I

WEATHER NOTES:_____

DATE _____ WELL DEPTH: 34.9 FT. WATER DEPTH: _____ FT.

WELL VOLUME: _____ GAL. TOTAL VOLUME PURGED _____ GAL.
1.25" = 0.06 2" = 0.163
ZONE MONITORED: ___OB___ WELL DIAMETER: ___2.0___ "

SAMPLE PURGE DATA:

START _____ GAL.
TEMP. _____ DEG C.
SPCON_____ MOHS
TURBID. _____ NTU'S
pH _____
TIME _____
HR/MIN _____
TOTAL
VOL. _____ GALS.

START_____GAL.
TEMP. _____ DEG.C.
SPCON_____MOHS
TURBID._____NTU'S
pH _____
TIME_____
HR/MIN_____
TOTAL
VOL. _____GALS.

START_____GAL.
TEMP. _____DEG.C.
SPCON_____MOHS
TURBID._____NTU'S
pH_____
TIME_____
HR/MIN_____
TOTAL
VOL._____GALS.

START _____ GAL.
TEMP. _____ DEG.F.
SPCON_____ MOHS
TURBID. _____ NTU'S
pH _____
TIME _____
HR/MIN _____
PURGE
VOL. _____ GALS.

START_____GAL.
TEMP. _____ DEG.F.
SPCON_____MOHS
TURBID._____NTU'S
pH _____
TIME_____
HR/MIN_____
PURGE
VOL. _____GALS.

SAMPLING
TEMP. _____DEG.F.
SPCON_____MOHS
TURBID._____NTU'S
pH_____
TIME_____
FINAL LEVEL _____
FINAL H20 QTY _____

REMARKS/OBSERVATIONS _____
_____
_____
_____

SAMPLE NUMBER_____TIME SAMPLED:_____ DATE_____
QA/QC Y/N MS? MSD? FIELD BLANKS?_____
DEC SPLIT Y/N VOCs TOC TOTAL PHENOLICS
PURGING CREW _____
SAMPLING CREW _____

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GLENN SPRINGS HOLDINGS
DUREZ INLET MONITORING
GROUNDWATER FIELD SAMPLE/PURGE RECORD

STATION # 19I

WEATHER NOTES:_____

DATE _____ WELL DEPTH: 35.4 FT. WATER DEPTH: _____ FT.

WELL VOLUME: _____ GAL. TOTAL VOLUME PURGED _____ GAL.
1.25" = 0.06 2" = 0.163
ZONE MONITORED: ___OB___ WELL DIAMETER: ___2.0___ "

SAMPLE PURGE DATA:

START _____ GAL.
TEMP. _____ DEG C.
SPCON_____ MOHS
TURBID. _____ NTU'S
pH _____
TIME _____
HR/MIN _____
TOTAL
VOL. _____ GALS.

START_____GAL.
TEMP. _____ DEG.C.
SPCON_____MOHS
TURBID._____NTU'S
pH _____
TIME_____
HR/MIN_____
TOTAL
VOL. _____GALS.

START_____GAL.
TEMP. _____DEG.C.
SPCON_____MOHS
TURBID._____NTU'S
pH_____
TIME_____
HR/MIN_____
TOTAL
VOL._____GALS.

START _____ GAL.
TEMP. _____ DEG.F.
SPCON_____ MOHS
TURBID. _____ NTU'S
pH _____
TIME _____
HR/MIN _____
PURGE
VOL. _____ GALS.

START_____GAL.
TEMP. _____ DEG.F.
SPCON_____MOHS
TURBID._____NTU'S
pH _____
TIME_____
HR/MIN_____
PURGE
VOL. _____GALS.

SAMPLING
TEMP. _____DEG.F.
SPCON_____MOHS
TURBID._____NTU'S
pH_____
TIME_____
FINAL LEVEL _____
FINAL H20 QTY _____

REMARKS/OBSERVATIONS _____
_____
_____
_____

SAMPLE NUMBER_____TIME SAMPLED:_____ DATE_____
QA/QC Y/N MS? MSD? FIELD BLANKS?_____
DEC SPLIT Y/N VOCs TOC TOTAL PHENOLICS
PURGING CREW _____
SAMPLING CREW _____

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GLENN SPRINGS HOLDINGS
DUREZ INLET MONITORING
GROUNDWATER FIELD SAMPLE/PURGE RECORD

STATION # 20I

WEATHER NOTES:_____

DATE _____ WELL DEPTH: 34.5 FT. WATER DEPTH: _____ FT.

WELL VOLUME: _____ GAL. TOTAL VOLUME PURGED _____ GAL.
1.25" = 0.06 2" = 0.163
ZONE MONITORED: ___OB___ WELL DIAMETER: ___2.0___ "

SAMPLE PURGE DATA:

START _____ GAL.
TEMP. _____ DEG C.
SPCON_____ MOHS
TURBID. _____ NTU'S
pH _____
TIME _____
HR/MIN _____
TOTAL
VOL. _____ GALS.

START_____GAL.
TEMP. _____ DEG.C.
SPCON_____MOHS
TURBID._____NTU'S
pH _____
TIME_____
HR/MIN_____
TOTAL
VOL. _____GALS.

START_____GAL.
TEMP. _____DEG.C.
SPCON_____MOHS
TURBID._____NTU'S
pH_____
TIME_____
HR/MIN_____
TOTAL
VOL._____GALS.

START _____ GAL.
TEMP. _____ DEG.F.
SPCON_____ MOHS
TURBID. _____ NTU'S
pH _____
TIME _____
HR/MIN _____
PURGE
VOL. _____ GALS.

START_____GAL.
TEMP. _____ DEG.F.
SPCON_____MOHS
TURBID._____NTU'S
pH _____
TIME_____
HR/MIN_____
PURGE
VOL. _____GALS.

SAMPLING
TEMP. _____DEG.F.
SPCON_____MOHS
TURBID._____NTU'S
pH_____
TIME_____
FINAL LEVEL _____
FINAL H20 QTY _____

REMARKS/OBSERVATIONS _____
_____
_____
_____

SAMPLE NUMBER_____TIME SAMPLED:_____ DATE_____
QA/QC Y/N MS? MSD? FIELD BLANKS?_____
DEC SPLIT Y/N VOCs TOC TOTAL PHENOLICS
PURGING CREW _____
SAMPLING CREW _____

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GLENN SPRINGS HOLDINGS
DUREZ INLET MONITORING
GROUNDWATER FIELD SAMPLE/PURGE RECORD

STATION # 22I

WEATHER NOTES:_____

DATE _____ WELL DEPTH: 32.0 FT. WATER DEPTH: _____ FT.

WELL VOLUME: _____ GAL. TOTAL VOLUME PURGED _____ GAL.
1.25" = 0.06 2" = 0.163
ZONE MONITORED: ___OB___ WELL DIAMETER: ___2.0___ "

SAMPLE PURGE DATA:

START _____ GAL.
TEMP. _____ DEG C.
SPCON_____ MOHS
TURBID. _____ NTU'S
pH _____
TIME _____
HR/MIN _____
TOTAL
VOL. _____ GALS.

START_____GAL.
TEMP. _____DEG.C.
SPCON_____MOHS
TURBID._____NTU'S
pH _____
TIME_____
HR/MIN_____
TOTAL
VOL. _____GALS.

START_____GAL.
TEMP. _____DEG.C.
SPCON_____MOHS
TURBID._____NTU'S
pH_____
TIME_____
HR/MIN_____
TOTAL
VOL._____GALS.

START _____ GAL.
TEMP. _____ DEG.F.
SPCON_____ MOHS
TURBID. _____ NTU'S
pH _____
TIME _____
HR/MIN _____
PURGE
VOL. _____ GALS.

START_____GAL.
TEMP. _____DEG.F.
SPCON_____MOHS
TURBID._____NTU'S
pH _____
TIME_____
HR/MIN_____
PURGE
VOL. _____GALS.

SAMPLING
TEMP. _____DEG.F.
SPCON_____MOHS
TURBID._____NTU'S
pH_____
TIME_____
FINAL LEVEL _____
FINAL H20 QTY _____

REMARKS/OBSERVATIONS _____
_____
_____
_____

SAMPLE NUMBER_____TIME SAMPLED:_____ DATE_____
QA/QC Y/N MS? MSD? FIELD BLANKS?_____
DEC SPLIT Y/N VOCs TOC TOTAL PHENOLICS
PURGING CREW _____
SAMPLING CREW _____

Glenn Springs Holdings, Inc.
A subsidiary of Occidental Petroleum

SEMIANNUAL INSPECTION - DUREZ INLET

Site: Durez Inlet

Date: _____ **Weather:** _____

Inspector: _____

Inspection Item	Inspect For	
1. **Shoreline**	- signs of erosion	Y / N
2. **River Bank**	- signs of erosion	Y / N
3. **Aquatic Areas**	- signs of erosion	Y / N
4. **Cove Cap**	- signs of erosion/disturbance - exposed portion	Y / N
	- signs of erosion/disturbance - submerged portion	Y / N
5. **North Lobe**	- evidence of activity or penetration that could impact effectiveness of cutoff wall	Y / N

Comments/Remarks **(Note: If repair/maintenance is recommended, describe its location/extent below)**

Appendix D
GSH Field Protocols

1. FP-01A: Waste Management

Disposables (PPE, Towels, Tubing, etc.)

All field disposables will be placed in 55-gallon waste disposal drums at the Site for management as Hazardous Solid Waste.

Purge Water

All purge water generated from sampling activities will be disposed of at the Site water treatment plant.

Decontamination Liquids

Alconox® Wash: all decontamination wash is disposed of in the same manner as purged groundwater.

Solvents: minimal volumes of solvents are used. Small quantities of cleaners (Citri-Clean) that are spilled during decontamination may be washed into the decontamination containment area.

2. FP-02A: Groundwater Level Measurement Procedure

Equipment

1. Personal protective equipment (PPE) (according to Site HASP)
2. Keys to the wells
3. Water level indicator
4. Low phosphate soap (Alconox® or equivalent)
5. Decontamination solvents (site specific)
6. Distilled water
7. Paper towels
8. Buckets
9. Water level measurement form or field logbook
10. Pens with waterproof ink
11. Trash bags
12. Site map
13. A table of well depths and previous water level(s)

Pre-Field Activities

1. All personnel making depth to water measurements are required to have reviewed the Site HASP, have up-to-date OSHA Health and Safety Training, have up-to-date medical monitoring, and have reviewed the field procedure within 1 year of performing this task.
2. Collect equipment.
3. Using a glass of water, check that the water level indicator is functioning. Measure the distance from the reference point on the indicator probe to the 2-foot mark on the tape – this should be 2 feet.
4. Decontaminate the water level indicator. Wash the probe and entire length of tape with a low phosphate soap solution followed by a tap water rinse. Dry with a clean cloth or paper towel. If the tape or probe has been in contact with non-aqueous phase liquid (NAPL), remove NAPL with a rag soaked in Citri-Clean, followed by the soap wash described above and a water rinse. Any liquid wastes will be contained and disposed of as described below.

Field Procedures

1. Check well identification. If there is any uncertainty that the correct well is being measured, measure the total depth of the well using a separate tape with a solid weight. Compare the measured depth of the well with the reported depth of the well.
2. Check the condition of the protective casing, cement, etc., and make notes as necessary. (Serious problems regarding the well condition should be communicated to the project manager; e.g., the protective casing has been broken into). Problems that require general maintenance should be documented and added to the Well Maintenance List.
3. Remove the cap from the well. If there is a sound of air entering or escaping, make a note of this, and check to see if there is a vent hole in the cap.
4. Check for the measuring point mark on the well riser and for any sharp edges, which may damage the water level indicator tape.
5. Slowly lower the water level indicator probe until contact with the water surface is indicated, either by audible alarm or by light. To the extent possible, avoid dragging the indicator cable on the top edge of the well casing; this can damage the cable and potentially introduce shavings from the cable into the well.
6. Read the depth to water at the measuring point and record the measurement to the nearest 0.01 foot.
7. Retract the tape by winding onto the spool, holding a clean paper towel to remove water and/or debris.
8. For newly installed wells and wells with known contamination, decontaminate the probe and tape between wells with soap and water wash. Rinse with distilled or deionized water. If necessary, decontamination solvents may be used to remove heavy contamination.
9. Replace the well cap, and re-lock the well.

Note: Whenever possible, water level measurements should be collected from least to most contaminated wells.

Decontamination of Water Level Indicator

At the end of each day of use, decontaminate the water level indicator as described under Pre-Field Activities, above.

Disposal of Wastes

All solid waste materials from monitoring will be placed in a plastic garbage bag. At the end of each day, these wastes will be placed in an approved/labeled 55-gallon waste disposal drum at Site for management according to Field Procedure FP-01A.

Reporting

Field data will be entered into the field database management system or an Excel spreadsheet. The field manager will specify formats and procedure.

3. FP-03B: NAPL Thickness Measurement Procedure

Equipment

1. Personal Protective Equipment
2. NAPL thickness form or log-book
3. Site map, and 200-foot measuring tape with 1-foot of 1/4-inch rebar. Attached rebar to the measuring tape with electrical tape
4. Solvent and rags/paper towels for cleaning NAPL from the tape and rebar

Field Procedure

1. Lower the measuring tape until the rebar contacts the bottom of the well.
2. Record the depth to the bottom of the well from top of casing (or the appropriate reference used for water level measurements).
3. Slowly rewind tape and record NAPL thickness based on visual inspection of NAPL on the tape or rebar.
4. Decontaminate tape. Tape will be wiped clean with a rag soaked in Halso 99 or Cirti-Clean. Wipe solvents from the tape with clean paper towels and rinsed with water.
5. Repeat for next well.

Disposal of Wastes

All waste materials from sampling will be placed in a plastic garbage bag. At the end of each day, these wastes will be placed in an approved/labeled 55-gallon waste disposal drum at the Site for management according to field procedure FP-01A.

Reporting

Field data will be entered into the field database management system or an Excel spreadsheet. The Field Manager will specify formats and procedures.

4. FP-03C: NAPL Removal From Wells

Equipment

1. Personal Protective Equipment
2. Tubing and foot valve by hand or using a gasoline or electric powered pump actuators (Waterra Hydorlift or equivalent), persitoltic pump, or balier

Field Procedure

1. Open monitoring well
2. Measure water level
3. Send tubing down or bailer to the bottom of the well
4. Purge monitoring well location with selected purge equipment until the NAPL has been removed
5. Collect NAPL in plastic jugs or other appropriate containers
6. Remove purging equipment
7. Close monitoring well
8. Take NAPL containers to appropriate storage or disposal facility

Disposal of Wastes

All waste materials from removing NAPL (i.e., gloves, etc.) will be placed in a plastic garbage bag. At the end of each day, these wastes will be placed in an approved/labeled 55-gallon waste disposal drum at the Site for management according to field procedure FP-01A.

Reporting

Field data will be entered into the field database management system or an Excel spreadsheet. The Field Manager will specify formats and procedures.

5. FP-04E: Groundwater Sampling – Low-Flow Purge and Sampling

Equipment

1. PPE.
2. Purging equipment: water level indicator, pumps (Grundfos, peristaltic pumps, hand bailers, or bladder pumps), generator, and air compressor. Enough decontaminated pumps will be taken to the field to complete the day's sampling schedule. Water storage tank or buckets for purged water.
3. Field parameter monitoring instruments: flow-though cell and water level measurement tape.

4. Decontamination equipment: plastic sheeting, low phosphate soap (Alconox®), distilled water, paper towels, and buckets.

5. Groundwater sampling forms or field logbook and a Site map.

Pre-Field Activities

1. At least 4 weeks prior to the sampling event, complete appropriate sampling forms, and submit to the laboratory coordinator.

2. Contact laboratory to acquire sample bottles.

3. Prepare bottle labels (list of wells to sample is in the Site documents).

4. Print field log/data recording sheets.

5. Calibrate field parameter meters; record calibration results.

6. Decontaminate enough pumps to complete at least one day's sampling schedule. For peristaltic pumps, decontamination is replacement of used tubing with new tubing cleaned by the manufacturer. The following procedure is for any submersible pumps. Wearing appropriate PPE:

    - Remove all visible sediment/soil by hand brush scrubbing or power washing.
    - Remove drain plug from pump and drain trapped water. Replace the drain plug.
    - Submerge pump in a 5-gallon bucket of low-phosphate soap water, and recirculate soap solution for 5 minutes.
    - Remove drain plug from pump and drain trapped water. Replace the drain plug.
    - Submerge pump in a 5-gallon bucket of tap water, and recirculate water for 5 minutes.
    - Rinse equipment with tap water.
    - An equipment blank may be required. The equipment blank is collected by pouring de-ionized water into the top of the pump and collecting the water in sample jars as it runs off the clean pump. Equipment blanks should be managed consistent with water samples as described below.
    - Following decontamination, the pumps shall be placed n a clean plastic bag and stored for the next use.

If the pump is contaminated with NAPL, the pump will be cleaned outside with Citri-Clean, pressure washed outside, the drain plug removed to drain residual water and replaced, run through a 5-minute recirculation with a Citri-Clean solution, and then pressure washed. Following this aggressive cleaning, the procedure defined above will be completed.

Field Procedures

1. Measure the water level and record on the field log. Determine the volume of water in the well bore.

2. Install pump/tubing into well for purging. Lower pump/tubing to center of the screened interval.

3. Start pump and purge as follows:

   - Start pump and adjust flow rate to a rate sustainable by the well, if possible and no greater than 500 milliliters per minute (mL/min). The goal of the sampling is to purge and sample without significantly lowering the water level of the well.
   - Monitor field parameters (pH, specific conductance, oxidation reduction potential (ORP), dissolved oxygen (DO), turbidity, and temperature), water level, and pumping rate, and record on the field log in five minute intervals. One set of readings will be taken at the start of purging and an additional set of readings will be taken after each five minute interval.
   - Groundwater stabilization is considered as having been achieved when three consecutive readings for each of the field parameters, taken at 5-minute intervals, are within the following limits:

     1. pH ± 0.1 pH units of the average value of the three readings
     2. Temperature ±3 percent of the average value of the three readings
     3. Conductivity ±3 percent of the average value of the three readings
     4. ORP ±10 millivolts (mV) of the average value of the three readings
     5. DO ±10 percent of the average value of the three readings
     6. Turbidity ±10 percent of the average value of the three readings, or a final value of less than 5 nephelometric turbidity unit (NTU)

   - Stabilization will be considered as being complete when the field parameters have stabilized as indicated in the above table. Purging will continue if stabilization does not occur until a maximum of 20-screen volumes have been removed. The screen volume is based on screen length.
   - If the recharge to the well is insufficient to conduct low-flow sampling, the well will be pumped dry and allowed to recharge sufficiently for the collection of the groundwater sample volume. Wells that are purged dry are not required to meet the stabilization criteria detailed above.

4. Samples shall be collected directly from the pump discharge immediately after stabilization:

   - Note: if possible, sampling in the rain should be avoided to avoid cross-contamination from airborne contaminants picked up in the precipitation.
   - Wells should be sampled beginning with the lowest concentration wells, progressing to the highest concentration wells. This minimizes the potential for cross-contamination.

5. Securely pack samples in ice-filled coolers for shipment to the appropriate laboratory. Coolers must:

   - Have completed Chain of Custody forms in a ziplock bag in the cooler.
   - Be securely taped closed with security seals across the cooler opening.

6. Remove pump/tubing. Purge tubing can be returned to the well for reuse:

   - Care must be taken to ensure that the dedicated tubing is not contaminated when it is removed from the well, and that no debris is introduced to the well when the tubing is lowered into the well.

7. Manage purge water and sampling disposables as described below.

Disposal of Wastes

All solid waste materials from sampling will be placed in a plastic garbage bag. At the end of each day, these wastes will be placed in an approved/labeled 55-gallon waste disposal drum at the Site. Purge water and decontamination liquids will be collected. Solid and liquid waste will be managed according to Field Procedure FP-01A.

Reporting

Field data will be entered into the field database management system or an Excel spreadsheet. The Field Manager will specify formats and procedures.

A copy of the Chain of Custody forms must be sent to the Laboratory Coordinator.

6. FP-06A: Decontamination Cleaners

The following cleaners/solvents are used for decontamination. A short summary of the use and precautions to follow when using these cleaners is presented for each cleaner. These summaries are not complete, the manufacturer's guidelines and Material Safety Data Sheets (MSDS) should be read and understood before using any of these cleaners.

Low-Phosphate Soap: Alconox® or Equivalent

Alconox® is formulated to be "free rinsing" (e.g., easily rinsed off with running tap or distilled water) with virtually no redeposition of removed (and unwanted) materials, all of which translates to virtually a complete absence of residues.

Use Alconox® at a 1-percent solution, which is equivalent to approximately 2 1/2 tablespoons (1 1/4 ounces) per gallon of cold, warm, or hot water. Alconox® is not formulated for spray machines since it will foam. For critical cleaning, do final or all rinsing with distilled, deionized, or purified water.

Alconox® has a shelf life of 2 years after the date of manufacture.

Citri-Clean

Protective gloves and goggles should be worn when using Citri-Clean. Do not use near fire, flame, spark, or any ignition source. It is harmful if swallowed.

Heavily caked grease/NAPL areas should be scraped before application.

The standard solution for Citri-Clean is 15 percent (20 ounces of Citri-Clean concentrate in 1 gallon of water). Citri-Clean may be used at up to 100 percent concentrate to remove heavy contamination. Citri-Clean can be applied with sprayer or other conventional means. Following

application, allow the materials to stand for 2 to 10 minutes. After allowing the materials to stand, scrub the contaminated area, and flush with water to remove loose particles. Reapply to areas where stains remain or where heavy accumulations of oil, grease, or other contaminants have occurred.

7. FP-06B: DECONTAMINATION PROCEDURES

This procedure describes the methodology for cleaning of non-dedicated field and sampling equipment. The purpose of describing this procedure is to avoid or limit potential for cross-contamination due to reuse of dirty equipment.

Equipment

1. PPE
2. Non-phosphate soap
3. Deionized water
4. Tap water
5. Scrub brush
6. Abrasive pads (sponge-type pads)
7. Paper towels or cotton rags
8. Aluminum foil
9. Plastic bags
10. Equipment to be cleaned
11. Squirt bottles

Procedures

The general cleaning procedure for cleaning all groundwater sampling equipment is:

1. Mix up soap/water wash.
2. Disassemble all equipment if appropriate.
3. Removal all visible sediment/soil by scrubbing by hand.
4. Wet equipment with tap water.
5. Wash equipment with soapy water using scrub brush, or abrasive pad/sponge to remove all sediment/soil and discoloration.
6. Rinse equipment with tap water.
7. Rinse equipment with deionized water two times.
8. Allow equipment to air dry.
9. When dry - reassemble equipment and place in plastic bag to avoid re-contaminating equipment.

10. A rinse blank is required as part of the Long-Term Monitoring Program (LTMP) as a check on the adequacy of the cleaning process. This rinse blank is collected by pouring deionized water over the item of cleaned equipment and catching the water in an appropriate set of sample containers.

11. Decontamination wash water should be collected for proper disposal at the Site.

8. FP-07A: Monitoring Well Decommissioning Procedure

Although it is not part of routine activities at the Site, it may be necessary to decommission environmental monitoring wells when they are no longer needed or when their integrity is suspect or compromised. The draft document, *Groundwater Monitoring Well Decommissioning Procedures,* (NYSDEC Guidance) provides guidelines for decommissioning (abandoning, plugging) environmental monitoring wells. The following procedure summarizes these guidelines as they apply to the Site.

Preparation

Well information including current conditions, well logs, and laboratory analytical data collected from soil and/or groundwater will be reviewed. This information will aid in developing a scope of work, establishing health and safety protocol(s), developing an appropriate abandonment technique, and aid in real-time field decisions, if necessary, during the decommissioning process.

Selection of Decommissioning Method

The primary rationale for well decommissioning is to prevent contaminant migration along the disturbed construction zone created by the original well boring. This requires selection of a procedure that considers such factors as:

- Hydrogeological conditions at the well site.
- Presence/absence of contamination in the groundwater.
- Original construction details.

The four primary decommissioning procedures are:

1. Grouting the casing in place
2. Perforating the casing followed by grouting in place
3. Casing pulling
4. Overdrilling

Detailed discussion of the decommissioning selection process and methods are presented in the NYSDEC Guidance. The procedures for overburden and bedrock wells are discussed below.

Overburden Wells:

The procedures that will be used to decommission overburden wells are the casing pulling method. In this method, the well casing is lifted out of the borehole while grout is added into the borehole

using positive placement techniques to ground surface. If the situation is encountered where the well casing is unable to be pulled, an alternate method involving grouting in-place will be used. This procedure involves filling the casing with grout using positive placement techniques to a level of two feet below the land surface, cutting the well casing at the 2-foot depth, and removing the top portion of the casing and associated well materials from the ground. In addition, the upper two feet of the borehole will be filled to land surface.

Based on a review of the NYSDEC Guidance, grouting in place appears to be the most appropriate technology for bedrock monitoring wells at the Site.

Bedrock Monitoring Wells: Grouting In Place

Grouting in place is the simplest decommissioning procedure. This method is preferred for bedrock wells with casings 2 inches or greater in diameter. The method involves filling the casing and open interval with a cement-bentonite grout. Unless special conditions, such as grout flowing into fractures and not filling the borehole, or grout entry into the filter pack of a screened well is desired, the following grout mixture will be used:

- One 94-pound bag of Type I Portland Cement
- 3.9 pounds powdered bentonite
- 7.8 gallons of water

Based on past experience in the Lockport Bedrock, where there can be significant vertical flow in the open interval of a well, the flow may create "piping" conditions (an erosion of the cement-bentonite grout). The piping may result in an interconnection of flow zones within the abandoned well. Therefore, in wells with significant vertical flow, GSHI will modify the NYSDEC procedure as described below. The GSHI procedure is satisfactory for all wells; however, it is more time-consuming than the NYSDEC procedure. In wells with no apparent vertical flow, the NYSDEC Groundwater Monitoring Well Decommissioning Procedures may be followed.

Bedrock Wells: NYSDEC Procedure

The grout mixture will be placed using a tremie pipe at least 1 inch in diameter lowered to within 5 feet of the bottom of the borehole. The borehole will be filled with the grout mixture to the top of bedrock or 5 feet below grade, whichever is closer to grade. Any groundwater displaced during the placement of the grout will be containerized and managed according to Field Procedure FP-01A.

The grout will be allowed to set for a minimum of 24 hours. The casing will then be cut off at 5 feet below grade or at the top of bedrock. If the grout level has settled from the target 5 feet below grade or top of bedrock, additional grout will be added. To allow future location of the abandoned well, an iron marker detectable with a metal detector will be left in place. If steel casing (carbon or stainless) is left in the ground, this is a sufficient marker. Otherwise, a marker such as a large bolt should be placed on top of the grout. After adding the grout and iron marker, the unfilled portion of the borehole will be filled to ground surface with material appropriate to the intended land use. For example, concrete or asphalt will be patched with concrete or asphalt of the same type and thickness; grassed areas will be seeded; and topsoil – similar to native soil – will be used to restore the Site.

Bedrock Wells: GSHI Modification for Wells with Significant Vertical Flow

The GSHI modification replaces the cement-bentonite grout in the well open interval with bentonite chips. The well open interval will be filled with bentonite chips to at least 2 feet into the well casing. The chips will be introduced in 5-foot lifts. A predetermined volume of bentonite chips will be added to the well to create a 5-foot thickness of bentonite. Following the addition of each lift, a heavy cylindrical "tamp" will be lowered on a cable to the top of the bentonite chips and allowed to rest on the bentonite chips. The purpose of the tamp is to ensure that the bentonite chips are fully in place. A tape measure attached to the top of the tamp will be used to check that the actual thickness of bentonite is consistent with the expected thickness of the volume of chips added. The addition of bentonite chips will continue until the seal extends at least 2 feet into the well casing.

Field Oversight and Documentation

The on-Site inspector will document all well decommissioning activities according to procedures outlined in field procedure FP-09A. Additionally, records and forms will be maintained including the Monitoring Well Field Inspection Log and the Well Decommissioning Record.

All solid waste materials generated during the well decommissioning process will be managed in accordance with Field Procedure FP-01A.

9. FP-08A: Well Redevelopment

Occasionally a monitoring or purge well may require redevelopment or rehabilitation. Indications of the need for redevelopment may include a decrease in purge well pumping rate, siltation occurring in the screened intervals of wells, or lack of hydraulic response.

Preparation

Well information including current conditions, well logs, sampling logs, historical transmissivity or hydraulic conductivity values, and pumping rates will be reviewed. This information will aid in developing a scope of work, establishing health and safety protocol(s), determine whether redevelopment or rehabilitation is required, and aid in real-time field decisions, if necessary, during the redevelopment/rehabilitation process.

Equipment

1. PPE
2. Purging equipment: water level indicator, pumps (Grundfos, hand bailers, air lift), generator, air compressor
3. Water storage tank
4. Field parameter monitoring instruments (pH, specific conductance, temperature, and turbidimeter)
5. Electronic water level datalogger
6. Decontamination equipment: plastic sheeting, low phosphate soap (Alconox®), distilled water, paper towels, and buckets

Pre-Field Activities

1. Print field log/data recording sheets (preprinted with location IDs).
2. Calibrate pH, specific conductance, and turbidimeter instruments; record calibration results.
3. Decontaminate enough pumps to complete at least 1 day's redevelopment schedule. Use decontamination procedure defined in FP-04B.

Field Procedure – Well Redevelopment

1. Measure the water level and record on the field log. Determine the volume of water to be purged according to formulas on the well redevelopment form.
2. Install pump and surge block into well for purging. Lower pump to approximately 5 feet below the water surface:
    - Purge tubing is dedicated to each well and remains in the well between uses. A decontaminated pump will be used for well redevelopment. The dedicated tubing is pulled from the well and connected to the decontaminated pump.
    - Care must be taken to ensure that the dedicated tubing is not contaminated when it is removed from the well, and that no debris is introduced into the well when the pump is lowered.
3. Start the pump and purge as follows:
    - Start pump and adjust flow rate to the maximum sustainable by the well.
    - Surge the pump up and down over a 3- to 5-foot interval for 5 minutes. At the end of 5 minutes, lower the pump approximately 5 feet deeper into the well. Repeat this until the bottom of the well is reached.
    - Monitor field parameters (pH, conductivity, temperature, and turbidity), water level, pumping rate, and record on field log including the time of the measurements. One set of readings will be taken at the start of purging, and an additional set of readings will be taken after the removal of each standing well volume.
4. Remove pump and surge block and disconnect from purge tubing. Purge tubing should be returned to the well:
    - Care must be taken to ensure that the dedicated tubing is not contaminated when it is removed from the well, and that no debris is introduced to the well when the tubing is lowered.
5. Manage purge water as described in FP-04E above.

Disposal of Wastes

All solid waste materials from sampling will be placed in a plastic garbage bag. At the end of each day, these wastes will be placed in an approved/labeled 55-gallon waste disposal drum at the Site. Purge water, and decontamination liquids will be collected. Solid and liquid waste will be managed according to Field Procedure FP-01A.

Reporting

Field data will be entered into the field database management system or an Excel spreadsheet. The field manager will specify formats and procedures.

about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

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